73 Amateur Radio Today

MAY 1992
ISSUE #380
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A WGI Publication
International Edition

Easy Projects You Can Build

Low-Cost Component Analyzer

Log-Periodic Dipole For 2 Meters

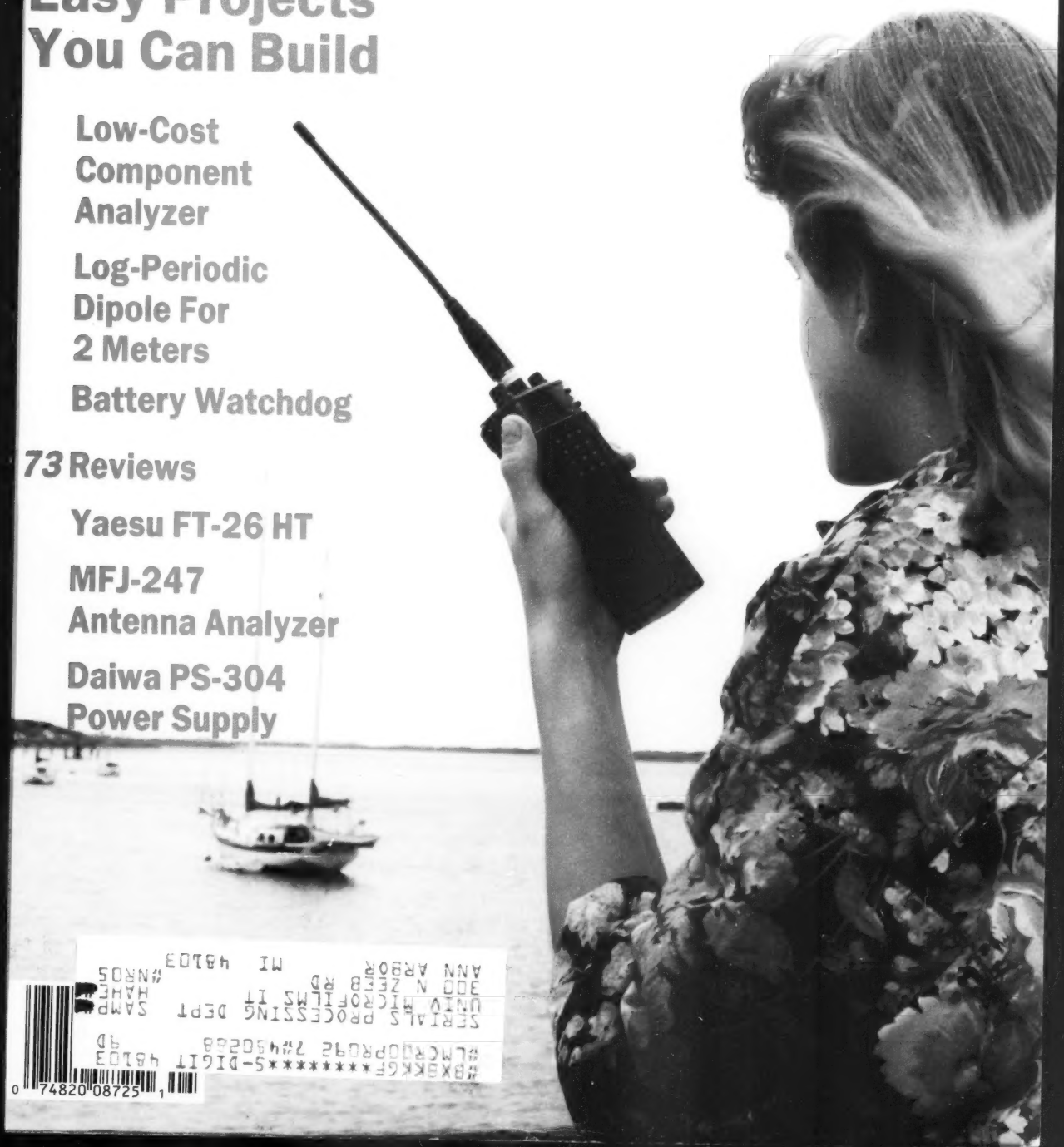
Battery Watchdog

73 Reviews

Yaesu FT-26 HT

MFJ-247 Antenna Analyzer

Daiwa PS-304 Power Supply



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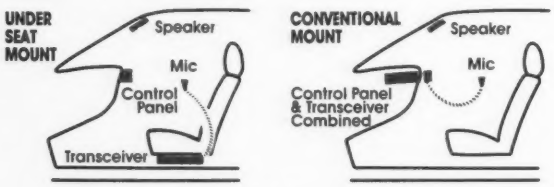

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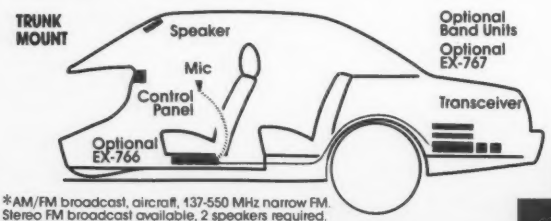

*AM/FM broadcast, aircraft, 137-550 MHz narrow FM. Stereo FM broadcast available, 2 speakers required.

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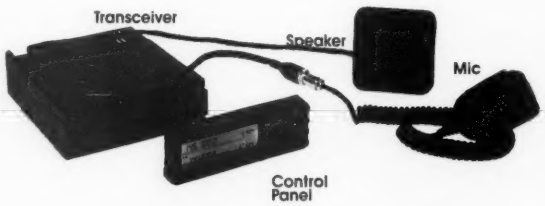

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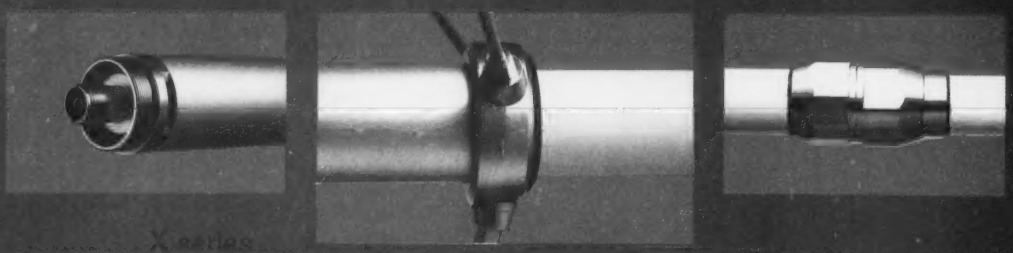
BASE/REPEATER ANTENNAS



X series

X-500HNA DUAL-BAND REPEATER VERSION

X-500NA DUAL-BAND REPEATER VERSION

X-200A DUAL-BAND REPEATER VERSION

X-50A DUAL-BAND REPEATER VERSION

PART #	FREQ	GAIN(dB)	PWR(W)	LENGTH(FT)	CONNECTOR	WIND RATING	ELEMENT PHASING
X-500HNA	2m/70cm	8.3/11.7	200	17.2	N	90	2m:3-5/8λ,70cm:8-5/8λ
X-500NA	2m/70cm	8.3/11.7	200	17.2	N	90	2m:3-5/8λ,70cm:8-5/8λ
X-200A	2m/70cm	6.0/8.0	200	8.3	UHF	112.5	2m:2-5/8λ,70cm:4-5/8λ
X-50A	2m/70cm	4.5/7.2	200	5.6	UHF	135	2m:6/8λ,70cm:3-5/8λ

U series VHF/UHF MULTIBAND

U-5000A

PART #	FREQ	GAIN(dB)	PWR(W)	LENGTH(FT)	CONNECTOR	WIND RATING	ELEMENT PHASING
U-300A	70cm/23cm	8.6/13.2	150	8.3	N	110	70cm:4-5/8λ, 23cm:10-5/8λ
U-5000A	2m/70cm /23cm	4.5/8.3 /11.7	150	6.0	N	135	2m:6/8λ,70cm:3-5/8λ, 23cm:7-5/8λ

F series VHF/UHF MONOBAND

F-23A

PART #	FREQ	GAIN(dB)	PWR(W)	LENGTH(FT)	CONNECTOR	WIND RATING	ELEMENT PHASING
DP-GH62	6m	6.0	200	21.0	UHF	78	2-5/8λ
F-22A	2m	6.7	200	10.5	UHF	112	2-7/8λ
F-23A	2m	7.8	200	15.0	UHF	90	3-5/8λ
F-142A	1 1/4m	5.5	200	6.0	UHF	110	2-5/8λ
F-718A	70cm	11.5	250	15.0	N	90	18-1/2λ
F-1230A	23cm	13.5	100	10.5	N	90	25-1/2λ

F-718L:420~430MHz,F-718J:430~440MHz

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- Wind speed ratings in excess of 90MPH

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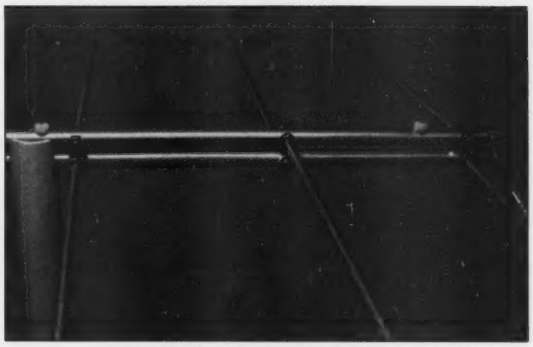

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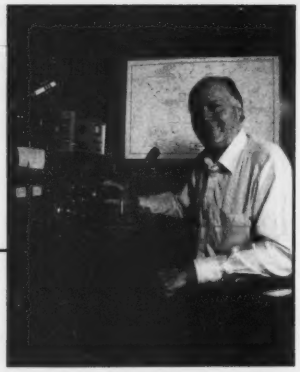

NEVER SAY DIE

Wayne Green W2NSD/1

Paying The Rent

If you've been reading my editorials . . . and if you have anything like the normal 70% retention for written matter . . . you are not unaware that I've been casting about, looking for help in coming up with some sort of plan which would help assure our survival as a hobby.

As I've mentioned, for those of you with incipient Alzheimer's, none of the original reasons for amateur radio's franchise to use our billions of dollars of bands hold much water these days. Knowing that commercial interests are getting more and more frantic for frequencies . . . knowing that several of the more frantic and better-heeled are busy taping the nonsense going on in our bands as a lever to force the FCC to rethink our allocations . . . I've been racking what little is left of my brain for some new rationale for us.

Indeed, I've thrown down the gauntlet on this one (clunk), asking for your ideas as a contribution to my talk at Dayton. Hey, you *are* going to be at Dayton, right? Let's see if we can break 30,000 attendance this year.

Hmmm, that gives me another idea. Let's set up a special room for the 14.313 group to caucus. Once we have 'em in there we can lock the doors and throw in a canister of nerve gas. I'll see if King Hussein, who seems to still be good buddies with Saddam these days, can get some from Saddam for us. Of course if you have a better idea for shutting these A-H's up, please advise. Seems to me that this is a clear case for justifiable euthanasia.

A recent CD release of Gilbert & Sullivan's "The Mikado" reminds me of Koko's song. He's the Lord High Executioner and he lists the people who should be on his list. Well, we hams are building a list too, and it ain't so little. Koko's list is of "society offenders who might well be underground and who never would be missed . . . I've got them on my list, I've got them on my list."

Well, we've got our list of offenders too. The hams who tell dirty jokes and use foul language over the air. The jammers. The pontifical gas bags. The hams who make mean racist remarks. The hams who put down youngster newcomers. And let's not forget any hams who broadcast endless self-promoting blather masquerading as public service.

Darn, I got carried away again. It's just that the vision of scourging the traitors to our hobby was a delicious thought I wanted to share. It's just a tired old man's dream.

Take The Bull

As I often say, it's time to take the bull by the horns and run with it. So here's my plan for building a whole new raison d'être for our hobby. And here's how you can help.

What I need are testimonials from you telling me how amateur radio has positively affected your life. I need stories of how getting interested in amateur radio as a kid (or later, even) changed your life.

"Hey, you are going to be at Dayton, right? Let's see if we can break 30,000 attendance this year."

I need success stories from you who've gone on as a result of amateur radio into high-tech careers. Further, if you've done anything outstanding as a result of that, that's even better.

I particularly need success stories from those of you who've started your own high-tech small businesses . . . since small business is the real strength of America. Indeed, 87% of all new jobs have been in small businesses in recent years. We don't need more megacorporations for Wall Street to juggle around. America needs tens of thousands of new small businesses. We need entrepreneurs. And we need 'em most in high-tech industries . . . just what we hams should be able to provide. Just what we have been providing . . . so let's start making this part of the picture visible.

If you'll write testimonials on how amateur radio benefited you careerwise, I'll publish your stories in *Radio Fun* and in the *NIAC Newsletter* (National Industry Advisory Committee) . . . which goes to the FCC commissioners and other key FCC decision makers. Let's swamp them with testimonials on how much amateur radio is helping the American economy via high-tech career paths.

If amateur radio has had a positive effect on your life, grab any writing implement you can find. Don't worry about grammar and spelling (we can fix all that), just get your story onto paper. Of course I prefer a disk and printout, but I'll take spiral bound notebook paper with the shreds still on and a stubby pencil. Don't let me down on this one. Please don't make me grovel and have to keep reminding you.

Look, if amateur radio has helped you in life, you owe it something. Well, here's your chance to start paying off that debt. Give me ammunition in the form of testimonials and I'll see that it gets used for the preservation of our hobby.

Please address your stories to Testy Wayne Green, *73 Magazine*, 70 Route 202 North, Peterborough NH 03458.

High-Tech Careers

It's always fun to get letters from readers thanking me for pushing them to start businesses. One recent letter thanked me for suggesting that the home security market was a good fit for hams. He got started in his spare time and gradually built quite a business. It had revenues of $11 million last year.

This is still a rapidly expanding field, with sales overall growing by 10% per year and no end in sight. When you consider that crime costs Americans over $250 per person a year . . . as compared to $12 in Japan . . . and since there's little likelihood of the government making any serious efforts to curb crime, it'll be a growing industry for a long time to come.

Indeed, we have more crime in America than any other developed country in the world, and by a wide margin. We have a greater percentage of our people in prison . . . over 1.5 million. Our main problem is in providing courts and building new prisons fast enough.

The upshot of all this is that the public is more and more responsible for its own protection. Police can't respond to burglar alarms in homes with any speed when 98% of the alarms are false, so the alarms are more harm than help. Handguns kill several times as many kids as burglars. So there's a wonderful growing market for home security.

And security systems do work. They tend to discourage burglars and get them to take their business to less protected homes.

Several readers have written thanking me for suggesting in my editorials about getting into this business.

I've also had several thank-yous from readers who've made careers out of selling computer security systems. Two of them said they followed my sneaky scheme for convincing companies about their computer security problems. They were amazed at how easy it was to listen from hundreds of feet away and get good copy.

Of course if you're happy working for someone else and aren't interested in being your own boss . . . and setting your own salary . . . and don't have to worry about being jettisoned when sales drop . . . or finding yourself a no-longer-needed middle management person . . . well, never mind.

I figure it's a lot easier to start a small business in your spare time before you're out of work and money than to wait until you're desperate. It's the "plan ahead" concept.

Once the business has grown to where it can support you, fine. Then you'll make it grow more and start hiring help . . . which is where you'll find out about the real world. Heh, heh.

The great proportion of small businesses are not aimed at high growth. Most of 'em are started by people preferring to be self-employed. They're not entrepreneurs, just small business people. Yet it's these small businesses which are the real strength of our country and provide 87% of all jobs.

Entrepreneurs are a different lot. They're not interested in making money or in security, they're after growth and have a mission which transcends money. Oh, they know they have to make money, but that's a detail. Hams jealous of what I'm doing sometimes accuse me of being after the buck. That's what psychology calls "projection." That's their problem, not mine. People with psychological problems tend to project them onto everyone else.

That's not a bad concept to keep in mind. When you meet someone who is distrustful, watch out! Projection is very common.

This recession has millions of Americans edgy, worrying about their jobs. Instead, it should be a time of opportunity. It's a time to look for new businesses that are needed.

For instance, a chap consulted with me recently. He'd been laid off from a large photo finishing company's upper management. Okay, here's a business he knows, so why not take advantage of it? I suggested he start putting card-

Continued on page 60

KENWOOD

Mobile Companion!

TM-241A
TM-441A/TM-541A

Compact FM Mobile transceivers

Here are your new mobile companions — at your service whenever you're on the road! Their compact size makes installation a snap, and the remote control options allow you to customize your installation for that "professional" look!

- **Wide band receiver coverage.** The TM-241A receives from 118–173.995 MHz. Transmit range is 144–148 MHz. (Modifiable for MARS and CAP operation, permits required.)
- **TM-441A** covers 438–449.995 MHz, and the **TM-531A** covers 1240–1299.995 MHz.
- **CTCSS encode built-in, selectable from the front panel.**
- **Selectable frequency steps** for quick and easy QSY.
- **TM-241A provides 50 W. TM-441A 35 W, and TM-541A 10 W.** Three power positions, 5, 10, and full. The TM-541A has two power positions, 1 and 10 watts.
- **20 full-function memory** channels store frequency, repeater offset, sub-tone frequencies, and repeater reverse information. **Repeater offset on 2m is automatically selected.** There are **four channels** for "odd split" operation.
- **Tone Alert System with Elapsed Time indicator.**
- **Auto-power off function, and time-out timer.**

RC-20 Remote Control Unit
As supplied, one RC-20 will control one transceiver. **Most often-used front panel functions** are controllable from the RC-20. The RC-20 and IF-20 combine to allow control of up to four radios.

- **Selective calling and pager option.** The DTU-2 option enables the Dual Tone Squelch System (DTSS), allowing selective calling and paging using standard DTMF tones.
- **Digital recording system option.** Used in conjunction with the tone alert system, the DRU-1 allows message storage of up to 32 seconds.
- **Multiple scanning functions.** Band and memory scan, with selectable scan stops and memory channel lock-out.
- **Large LCD display with four-step dimmer control.**
- **Automatic Lock Tuning (ALT) for the TM-541A.** Compensates for drift.

- **Supplied accessories.** Mounting bracket, DC cable, fuses, MC-44DM multi-function DTMF mic.

Optional accessories

- **DRU-1** Digital Recording Unit
- **DTU-2** DTSS unit • **IF-20** Interface unit, used with the RC-20, allows more than two transceivers to be remotely controlled • **MA-700** 2m/70cm dual band antenna with duplexer (mount not supplied) • **MB-201** Extra mounting bracket • **MC-44** Multi-function hand microphone • **MC-55** (8-pin) Mobile mic. with time-out timer • **MC-60A, MC-80, MC-85** Base station mics. • **PG-2N** Extra DC cable • **PG-3B** DC line noise filter • **PG-4G** Extra control cable • **PG-4H** Interface connecting cable • **PG-4J** Extension cable kit • **PS-50/PS-430** DC power supplies • **RC-10** Handset remote controller • **RC-20** Remote control head • **SP-41** Compact mobile speaker • **SP-50B** Mobile speaker • **TSU-6** Programmable CTCSS decoder

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LETTERS

Number 2 on your Feedback card

From the Hamshack

Willard Shears W2IOS, Rockford IL Well, Wayne, you did it. I've been a silent subscriber since 1962. I was W8HYE then, and promised not to live too long in order to get a lifetime subscription. I am a chief engineer at WIFR in Rockford, and am sort of tired of fixing the same stuff. I am a "fixer." I can fix about anything you can plug in. I want to teach this and other skills to the kids who have nowhere to go, and I would like to teach electronics and repair to the underprivileged.

I have had the luxury of being able to take time to have fun. I still enjoy designing things, re-using equipment that was ready for the scrap heap. I would like some ideas on where to go, what to do, to get some of that pork that is floating around to make some headway in getting a new generation of kids able to do something other than swap bad boxes when something breaks. Maybe you have an idea of how hard it is to get good maintenance techs; I know how hard it is. I want to start a tech school for kids, laid-off adults, and even dropouts who wake up. I want to make them even better than DeVry. I have had two DeVry grads, and they are better than a lot, but need a lot of training. If hamming would help, I would use it.

So, keep up the editorials. You finally got me off my duff to write. Let's get it going. I want to live long enough to give my four kids a problem. Meanwhile, I'll continue to OD on editorials. Most fun I've had in years.

Ed Fox, Morgan Hill CA This last summer, while vacationing at my in-laws', I found a notice about a class in the new no-code Tech license. It was taught by a remarkable man, Curtis Nakayama. His knowledge and stories, imparted in that wondrous soothing lilt from the Hawaiian islands was a marked contrast to other experiences I'd had with hams.

Like any other new ham, I went shopping. I stopped at the local store in San Jose. I'd been in there before, but now felt like I belonged. Imagine my surprise when I was ignored just like before. The other surprise was the cost!!

My other surprise was to not be contacted by anyone after receiving the license. I think that any organization or group fighting for its survival would have leaped at any prospective new member. But the ARRL didn't make any effort to involve me, even after I purchased material from them aimed at learning the code and the tricks to getting a new station started.

I read your editorials with each new issue of the magazine. I liked your editorial emphasizing the human communication part of ham radio. I disagree with most of your indictment of education. I agree with your comments about needing to welcome newcomers. And, your recent column about the limited utility of the Amateur Radio Service is precisely accurate.

Given the cost, the way the ham field has changed since I was a kid, and the problems I note in the various ham journals I have read, I fear I am going to be one of those who gets his first license and then quits. For me, the major drawing card was a chance to communicate with kindred spirits around the world, as exemplified by Curtis Nakayama.

As for education, there is a germ of truth in what you write, but your diatribes miss some difficult-to-accept truths about us as a country. Back when you were in school, and even when I was in school, the proportion of the population which was like you, and me, was much greater than today. Proportionally, we funded education at a much higher rate than that now. We systematically excluded difficult-to-educate students, counting on the job market to absorb them.

Today, most of America's students come from urban areas. Yet those urban areas feature schools neglected by the rest of us. We forced public educators to unionize because we constantly devalued and denigrated their efforts. It is a built-in contradiction to insist that educators become highly educated, then insist that their opinions and reasonings are not worthy of consideration. We give our kids to these professionals and then expect the professionals to do the work of the family and the society.

Make no mistake—there are some teachers who, as an administrator, I would love to remove from education. But, for every one of them, there are five to 10 teachers I would love to reward by doubling or tripling their salary. Would you tolerate a teacher making $100,000? I doubt it, but we have no trouble with salespeople, lawyers, accountants, and stockbrokers making that amount. None of these occupations produce wealth, or the means to increase knowledge. But, to entice our best into education with salaries like that is anathema. Then we rant and rave about our educational system failing us. Go figure it out, I can't.

Let me personalize the situation. A typical shack, as best I can figure from advertisements, must cost $3,000 to $5,000. How many hams would be willing to donate that amount to a school? Teachers and useless administrators are over-paid? Public schools are no longer seen as a part of us as a society. As your world of ham radio has changed, so has the make-up and demands of public schools. That $3,000 to $5,000 we would not think of parting with reflects the cost of educating a student today.

I encourage parents and communities to take back their schools if they feel left out. But, take them back by re-owning them. Put in your time there, even if your kids are long gone and even if the kids don't look like your kids did. Insist that buildings and facilities are ones you would like to work in, or that you would want your kids to work in. Insist that schools excel, but be there to acknowledge all the steps along the way to that excellence.

If we want the achievement of Japanese and Korean schools, we must change our attitude toward schools. We must prize them. We must believe that schools and school people are just like we are and respond to approval.

Yes, schools need to change. We cannot continue doing business as usual in many instances. Few among us eagerly seeks change. Even hams are known to cling to familiar ways which are no longer appropriate. Ham radio is a hobby, whereas education is a necessity. We cannot let public education die or disintegrate.

You seek ideas for the perpetuation of the Amateur Radio Service. Why not link hams with schools? Grant school-based shacks unique frequencies and priviliges to encourage hams to enter schools. Encourage the ARRL to reach out to schools. For example, here in California, funds are available for restructuring schools. Why can't hams be a part of a changed delivery system for students?

Most likely we will hear a response like, "That's the school's job. I did my time with my kids." At that point, Mr. Green, I rest my case about the demise of the Amateur Radio Service and the continued deprivation of critical resources to our kids.

As for my ham career, it's too soon to tell. Maybe my path will cross another Curtis Nakayama. Maybe a rig will fall off a passing truck. My interest is certainly waning. From a different perspective than yours, I ask, "What's in ham radio for me?"

I hope our interests converage enough to save both our interests, education for me and ham radio for you.

R.L. Stevenson VY2RLS, P.E.I. Canada Regarding your "Never Say Die" column about old-timers in the September 1991 issue: It was for this particular reason that we founded a new club. We amateurs, new to the fraternity, who have the basic qualifications, had been stifled by the old fogies who wanted nothing more than to have control of the club and all (if any) resources. In fact, the members of the local "seniors" amateur club are now the executives of the local open club. The former club was initiated to "further amateurism among seniors," or in my opinion, to get as much money as possible from the government for a seniors' project grant. They got ($20,000) to buy equipment. This sum was larger than anything any of the old farts had ever seen in their lives and they couldn't figure out how to spend it wisely. They went out and bought two (yes, two!) of just about everything (in case one breaks down).

Now the Seniors' Club has two TS440s, two handhelds, two power supplies, and an autopatch (that, incidentlly, seldom works, but they only got one of them). Anyway, my point is this: The seniors wanted to rest in the secure knowledge that the new upstarts would be subservient to them because, after all, who knows more about radios and equipment than a "senior"? Albeit to their dismay, a number of us wanted to go a little further and get our Advanced license but we couldn't because of the stifling atmosphere. Now, a number of us are striving for that goal and anticipate a very near completion date. So, in response to your column, you hit it right on target!

I find *73* to be a very informative and enlightening magazine. In fact, a buddy of mine and I buy alternating months and when we're finished reading we leave it in our clubroom for the rest of the members to peruse.

Greg Smith N8PPZ, W. Carrollton OH I really love your editorials. It is nice to finally find someone who thinks like I do. I have been a no-code tech since August, and I am proud of my call. I enjoy ham radio so much that I keep trying to make it better, but I don't think anyone is willing to help my crusade.

I am 21 years old and I go to Sinclair Community College full time, majoring in mass communications. I work part-time for WDTN TV-2 here in town as a robotic camera systems operator/programmer/crew trainer. I also produce my own television shows at the local public access cable station. I am very busy, but yet I manage to have time to participate in the number one hobby in the world.

When I got some spare time I decided to spearhead an effort to start an amateur radio club at the college. I never imagined I would get so much negative reaction from the Student Government Association. They must approve all clubs. I had done some research and found out that at one time there had been a ham club there, but it died over five years ago. There is still station equipment being stored on campus, and the triband beam is still up on top of one of the buildings, in decent shape. So when I approached the SGA with my idea, they said, "It wouldn't appeal to enough students." That's a bunch of crap. I personally know seven hams on campus, two of whom teach classes at the school and would be willing to sponsor the club. In a school that has over 20,000 students enrolled, I calculate between 15% and 20% are hams, scanner buffs, SWLs, or are interested in learning about ham radio. That is more than the basketball team, the chess club, or any other organization on campus. I believe the key to making such a club successful is in the way it is marketed and how visible it is. What could be a better teaching aid for a student in social studies who wants to learn about foreign countries? Or a communications major who wants to develop skills? Or an electronics student who needs hands-on training? All of these areas have potential. The SGA is too narrow-minded to see this.

Another area I think needs to be improved in ham radio is the upgrading of no-coders. I have found that the local ham club doesn't seem receptive when asked if they would provide a code-only course for us to upgrade to Technician-plus status. They say they already offer Novice and General classes. Well, I don't need the Novice theory, and I don't know the code well enough to take the General class. I am struggling through with the tapes and computer programs, so one way or another I WILL pass the five-word code test before I attempt to take the General class.

Once I do manage to upgrade I will be in a unique position to teach ham radio: Public Access Television. I can produce a training show for those still interested in the Novice ticket, the no-coders wishing to get code, and the people who want to get a no-code license. I guarantee it will be a lot more convenient than the occasional classes the local club offers. It might just make our stalwart leaders get off their duffs and do something constructive for the hobby, once they see an increase of people testing, and a decrease in attendance in their classes.

As you can see, Wayne, I am doing something. I am trying to promote our hobby, and I am trying to infuse fresh blood into it. I and others like me are the future of not only ham radio, but America in general. Are we going to sit back and accept tired old practices, just because that was the way things were done in the past, or are we going to change things and move into the '90s? After what I have gone through, and continue to struggle against, I can see why, after all the years, you have been doing what you do, and why you continue to do it. 73

QRX . . .

73 Has Moved

***73 Amateur Radio Today* has a new headquarters.** As of March 31, 1992, our address will be: *73 Amateur Radio Today*, 70 Route 202 North, Peterborough NH 03458; telephone: (603) 924–0058.

Bringing the Novice Class Under the VEC System

Attorneys for the American Radio Relay League and the W5YI-VEC have filed separate petitions for rulemaking with the Federal Communications Commission requesting that future Novice class amateur radio license examinations be administered under the current VEC System.

The W5YI-VEC and the American Radio Relay League VEC together account for approximately 80% of all operator license examinations administered in the VEC System. The W5YI-VEC petition was filed on February 26 and coordinated with the ARRL request filed the following day.

The privatization of the amateur operator license examination function from the government to the VEC System has turned out to be a success story, of which the FCC and the amateur community can rightfully be proud. According to FCC statistics, last year 103,251 applicants were served at 8,118 test sessions, an increase of 62% over the previous year.

W5YI-VEC pointed out that "Newcomers have flocked to the service via the Technician class license, despite the fact that the examination setting is less formal than the Novice class setting, and despite the fact that they may be charged a modest fee to defray the cost of the examination." *TNX W5YI Report, March 15, 1992.*

Armed Forces Day Communication Celebration

On Saturday, May 16, 1992, the Army, Navy, Marine Corps and Air Force will cosponsor the 43rd Annual Armed Forces Day Communication Celebration. The Amateur Radio Program, presented in celebration of Armed Forces Day per Department of Defense directives, will feature the traditional military-to-amateur crossband communication test and message receiving test. The tests give amateur radio operators and shortwave listeners an opportunity to demonstrate their individual technical skill and to receive recognition from the Secretary of Defense or the appropriate military radio station for their proven expertise.

The proceeding will include operations in continuous wave (CW), single sideband voice (SSB) and radioteletype (RTTY). Participating military radio stations will award commemorative acknowledgement (QSL) cards to amateur radio operators achieving a verified two-way radio contact. Special commemorative certificates will be awarded to anyone who receives and accurately copies the Armed Forces Day CW and/or RTTY message from the Secretary of Defense. All contacts must be acknowledged by QSL card or certificate to validate military interest in these operators.

Military-to-amateur crossband operations will take place from 16/1300Z (UTC) to 17/0200Z (UTC) May 1992. Military stations will transmit on selected military frequencies and listen for amateur radio stations in the amateur bands indicated below. Frequencies assigned below are the "Assigned Frequency." To derive the "Window Frequency," drop 1.5 kHz from the "Assigned Frequency" for USB. For example: 4005.0 kHz (Assigned Frequency) – 1.5 kHz = 4003.5 kHz (Window/Dial Frequency). The military operator will announce the specific amateur band frequency being monitored. Duration of each contact should be limited to three minutes.

Ham Testing Fraud

The FCC has used amateurs working in an undercover sting operation to investigate alleged VE testing fraud at ham radio schools in California. The FCC acted on complaints that applicants were able to buy Extra class licenses at some VE test sessions and in some amateur radio schools.

The undercover hams, posing as applicants, used concealed tape recorders. Evidence of wrongdoing was found, according to the FCC, but no names have been released, pending completion of the investigation. *TNX "The Birmingham," newsletter of the Birmingham (Alabama) Amateur Radio Club, February 1992, and the ARNS Bulletin, March 1992.*

Station	Military Frequency	Emission	Amateur Bands
AAE	4030.5 kHz	LSB	80 Meters
Army HF/MARS Radio	7358.5 kHz	RTTY/CW	40 Meters
Facility	13994.5 kHz	USB	20 Meters
Fort Sam, Houston TX	20941.5 kHz	CW	15 Meters
	27992.5 kHz	USB	10 Meters
AAH	4021.5 kHz	LSB	80 Meters
ARMY HF/MARS Radio Facility	6988.0 kHz	RTTY/CW	40 Meters
Fort Lewis, WA	10151.5 kHz	USB/CW	30 Meters
	14488.5 kHz	USB	20 Meters
	20975.0 kHz	USB	15 Meters
	20995.5 kHz	RTTY/CW	15 Meters
	27820.0 kHz	USB	10 Meters
AAR	4033.5 kHz	LSB	80 Meters
ARMY HF MARS Radio Facility	7309.5 kHz	RTTY/CW	40 Meters
Fort Bragg, NC	14440.0 kHz	USB	20 Meters
	20105.5 kHz	USB	15 Meters
	27810.0 kHz	USB	10 Meters
AIR	4025.0 kHz	LSB	80 Meters
89th Communications Group	6995.5 kHz	CW	40 Meters
	7315.0 kHz	LSB	40 Meters
Andrews AFB	13986.5 kHz	RTTY	20 Meters
Washington, D.C.	13997.5 kHz	CW	20 Meters
	14408.0 kHz	USB	20 Meters
NAM	4005.0 kHz	USB	80 Meters
Naval Computer Telecommunication Area Master Station LANT Norfolk, VA	14400.0 kHz	USB/RTTY/CW	20 Meters
NAV HQ	7372.5 kHz	RTTY/CW	40 Meters
Navy-Marine Corps MARS Radio Station Cheltenham, MD	14389.5 kHz	USB	20 Meters
NAV-84008.5 kHz	Various		80 Meters
DIRNAVMARCORMARS REG EIGHT 530 Peltier Ave.	14820.0 kHz	Various	20 Meters
Honolulu, HI	18900.0 kHz	Various	20 Meters
NMH	4015.0 kHz	CW	80 Meters
Coast Guard Radio Station	7346.5 kHz	LSB	40 Meters
Alexandria, VA	14440.0 kHz	RTTY/CW	20 Meters
	20937.5 kHz	USB	15 Meters
NMN	7393.0 kHz	RTTY/CW	40 Meters
Coast Guard Comm. Area Master Station Cheasapeake, VA			
NPG Naval Comm. Station	6970.0 kHz	CW	40 Meters
Stockton, CA	7301.5 kHz	LSB	40 Meters
	7365.0 kHz	CW	40 Meters
	10259.5 kHz	CW	30 Meters
	13927.5 kHz	RTTY	20 Meters
	13975.5 kHz	CW	20 Meters
	14375.5 kHz	USB	20 Meters
	20625.0 kHz	USB	15 Meters
	24805.0 kHz	CW	12 Meters
	27950.0 kHz	USB	10 Meters
NPL Naval Comm. Station	7382.5 kHz	RTTY	40 Meters
San Diego, CA	14385.0 kHz	USB	20 Meters
NZJ Marine Corps Air Sta.	7375.0 kHz	RTTY	40 Meters
El Toro, CA	14480.0 kHz	USB	20 Meters
WAR HQ Army MARS Radio Station	4018.5 kHz	LSB	80 Meters
Fort Detrick, MD	6998.5 kHz	CW	40 Meters
	13992.5 kHz	RTTY/CW	20 Meters
	14403.5 kHz	USB	20 Meters
	20995.5 kHz	USB	15 Meters

a. Stations copying AIR send entries to:
Armed Forces Day Celebration
89CG/DØJM
Andrews AFB, D.C. 20331-6345

b. Stations copying NAM, NAV, NMH, NMN, NPG, NPL, NZJ and NAV-8 send entries to:
Armed Forces Day Celebration
HQ Navy-Marine Corps MARS
BLDG-13 NAVCOMM DET Cheltenham
Washington, D.C. 20397-5161

c. Stations copying AAE, AAH, AAR, or WAR send entries to:
Armed Forces Day Celebration
Department of the Army
U.S. Army Information Systems Command
ATTN: ASOP-HF
Fort Huachuca, AZ 85613-5000

(This is a partial listing. For a complete list of frequencies and modes, contact one of the stations listed above.)

Table 1.

Poor Ham's Dynamic Component Analyzer

Build your own circuit detective.

by T. S. Rowinski KA1MDA

As technology becomes more complex, the test equipment needed to troubleshoot problems becomes more complicated as well. Twenty years ago, the only test gear required to repair virtually any consumer electronics product was a VOM, and an oscilloscope was a luxury many had to do without. Today, an oscilloscope is a must!

One of the newer diagnostic trends involves the use of active component analyzers. Part oscilloscope, part curve tracer, and part signal injector, these units typically fall into two categories: self-contained portables with built-in CRT, and accessory units (usually part of a test jig) designed to be used with an outboard oscilloscope. Both types are priced beyond the reach of the average ham or electronics hobbyist, with prices ranging from $400 to $1,000!

After a bit of research, it became apparent that all these units functioned on the same principle. The analyzer supplies a current-limited AC sine wave to the device being tested, and displays the resulting current and voltage relationships on an X-Y display CRT. This creates a "signature," a unique pattern which identifies the characteristics of the device being tested. The commercially available units also feature a myriad of bells and whistles, such as automatic signature comparison, various test frequencies, waveform storage, etc.

Since I already owned an oscilloscope, all I needed was an accessory-type analyzer. I sat down at the drawing board and came up with the Poor Ham's Component Analyzer. Although this unit lacks the bells and whistles of the big bucks analyzers, its basic effectiveness and operation are identical. The project itself is very easy to assemble, and requires only a handful of common junk box or hamfest parts. All components also have a high "fudge factor" and can be substituted for almost anything the builder has on hand. For those without a junk box, a parts list of Radio Shack equivalent part numbers is included. The best news, though, is that total cost of construction, if all parts are purchased new, is less than $25!

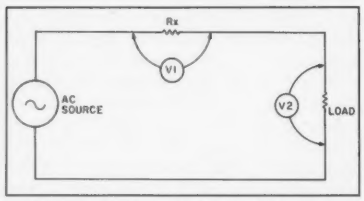


Figure 1. Theoretical circuit diagram.

How it Works

The basic circuit theory is quite simple (see Figure 1). A load is fed by an AC source through a current-limiting resistor. A voltage reading at point V2 indicates voltage across the load. According to Ohm's law (E = I/R), resistor Rx will develop a voltage drop proportional to the current passing through it. The higher the current drawn by the load, the higher the voltage drop across Rx. A voltage reading taken at point V1 is directly proportional to the current drawn by the load. If the load is purely resistive, both V1 and V2 would rise and fall together as the source voltage increased and decreased through each cycle. If we replace the load with a non-linear device such as a diode, V1 and V2 would no longer read in unison. During the first half-cycle the diode might be reverse biased, giving a high voltage and low current reading. During some point of the next half cycle, the diode would become forward biased and conduct, producing a high current and low voltage reading. If an X-Y oscilloscope were connected across points V1 and V2, the scope would display the diode's switching signature and become a dynamic component analyzer!

The actual circuit is not much more complicated than that! (Refer to the schematic in Figure 2.) Transformer T1 converts the 120 volt AC current to 12 volts across the full secondary winding, or 6 volts across the center tap to either end. Resistors R1 (50 ohm, 1 watt) and R2 (10k ohm, 1/4 watt) limit the maximum current which can be obtained from T1 on the low and high range respectively, and create the voltage drop which is fed to the scope vertical amplifier via J1 to display current. Note that the parts list shows two 100 ohm resistors for R1—this is because Radio Shack doesn't stock a 50 ohm, 1 watt resistor, so we make our own by connecting two 100 ohm resistors in parallel. If a 1 watt resistor between 47 and 56 ohms is available, it can be substituted for the resistors shown for R1 in the parts list. Switch S2 is a DPDT type and acts as a range selector. Section S2B switches between the 6.3 and 12.6 volt windings of T1, while section S2A connects the scope vertical input via J1 to the appropriate current-limiting resistor. The test leads are connected to J3, and the oscilloscope horizontal amplifier measures voltage at J2. I1 is a neon lamp assembly with built-in dropping resistor and acts as a power-on indicator. Switch S1 serves as the main power switch, and fuse F1 provides over-current protection in the event of shorted wiring or transformer windings.

Construction

Before beginning construction of this project, please remember that this circuit is powered by 120 volt AC current. The voltages present on the primary side of T1 can be LETHAL! ALWAYS UNPLUG THE UNIT FROM THE ELECTRICAL OUTLET BEFORE OPENING THE CASE! Likewise, never attempt to troubleshoot or modify the dynamic component analyzer while the circuit is live. When working on the unit, do not rely on the front panel power switch to remove power—always unplug the power cord! For additional safety, I recommend that the unit be assembled in a plastic case—do not use a metal chassis! If using a polarized power cord, connect the wider blade to one end of T1's primary and the narrower blade to fuse F1.

Component location and layout is non-critical, and virtually any form of construc-

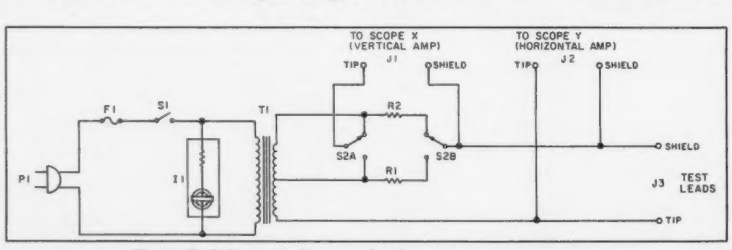
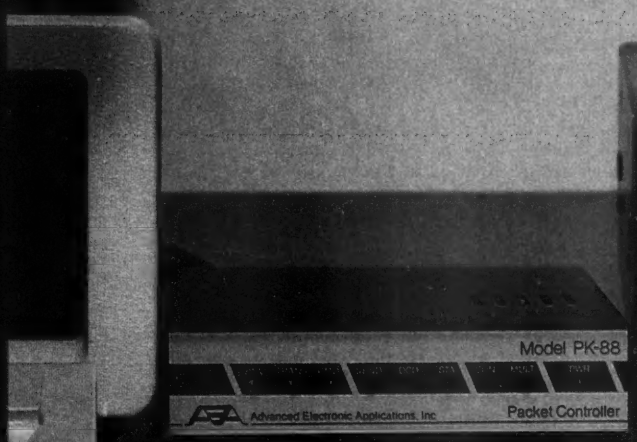


Figure 2. Schematic diagram for dynamic component tester.

Now you see it....



The PK-88 is becoming one of the most widely used packet controllers in the world. In some areas, it is outselling its closest competitor by 10 to 1!

With the built-in 18k byte maildrop, you can use it as a "mini-BBS" in your area, and even automatically forward and reverse-forward traffic with your local PBBS. Or, just use it as a packet controller to help you catch that rare DX on your local DX packet cluster.

The PK-88 can be used with a dumb terminal or any computer with an RS-232 port and a communication software program (such as PC-Pakratt-88).

Now you don't.

The PCB-88 includes all the features of the PK-88 (above), and is easily installed in your IBM PC or compatible computer. Even if your shack is short on space, you can still have the best packet setup available.

In addition to the PK-88's features, the PCB-88 also includes TAPR's state machine DCD circuit and modem disconnect header for added performance and convenience.

To help make setup and operation a breeze, we've included AEA's powerful yet simple PC-Pakratt-88 software and an AC-1 12 VDC adapter (keeps the PCB-88 on when the computer is off – U.S. models only).

The PK-88 and PCB-88 packet controllers are the best money can buy, and that's no illusion!

tion can be employed, such as perf board, printed circuit board, or point-to point wiring. The prototype incorporated point-to-point wiring across a single, insulated solder-lug terminal strip. The unit can be housed in nearly any type of enclosure, as long as the material is non-conductive. The original unit was built into a 5-1/4″ wide, 2-1/2″ high, 5″ deep plastic project case, which allowed for an open, uncluttered parts layout. If the selected enclosure has no provisions for air circulation, drill five or six 1/4″ holes in an inconspicuous area to allow for the escape of heat generated by transformer T1. Although T1 operates at a relatively cool temperature, heat build-up could become a problem if the analyzer were housed in a small, non-vented enclosure and operated for extended periods of time. Although Radio Shack appears to have discontinued the enclosure used in this article, they offer a number of other suitable enclosures. Figure 3 shows the front panel layout used for the original. I used BNC jacks for J1/J2/J3, although banana jacks or five-way binding posts could have been used just as easily. When wiring the jacks, pay close attention to the polarity—all three jacks should have their negative (shielded) lead hooked to the same point. Reversing the connections on one jack will cause the analyzer to display erroneous patterns or not work at all!

For those who prefer to roll their own with whatever parts are on hand, only a few simple calculations are needed to design a functional unit. Transformer T1 is the heart of the project, and must have a center tap secondary with a terminal voltage between 9 and 20 volts AC. Let's assume the builder has an 18 volt transformer on hand. We need to calculate the ohmic value for R1 to limit current in the low range (R1) to no more than 125 mA. Our hypothetical transformer develops 9 volts across half the secondary, so we use Ohm's law (R = E/I) which gives us R = 9/.125 (remember to convert milliamps to amps), or 72 ohms. The next highest value

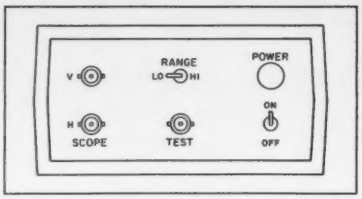


Figure 3. Front panel component layout.

commercially available resistor is 100 ohms. Using I = E/R, we can calculate the actual current as I = 9/100, which produces 0.09 amp, or 90 mA. To calculate power rating, we use the formula P = IE. Plugging in the numbers, P = 0.09 x 9, or 0.81 watts. Thus a 100 ohm, 1 watt resistor is required for R1. To calculate the value of R2, we use 18 volts, since the entire transformer winding is used in HIGH range, and we want to limit current to a maximum of 1 mA. Using R = E/I, we get R = 18/0.001, or 18,000 ohms. The next highest commercially available value is 22k ohms. Calculating for actual current using I = E/R produces I = 18/22,000, or 0.00081 amps (0.81 milliamps). Power rating (P = IE) calculates to P = 0.00081 x 18, or 0.0145 watts. So, for R2 we need a 22k ohm, 1/4 watt resistor. Using this example, it is possible to quickly calculate the proper component values and for virtually any transformer!

Initial Check Out

Before plugging in the analyzer, a few safety checks must be made to insure proper wiring and operator safety. The values listed below are for units built with the parts specified in the parts list. Set a VOM or DMM to the OHMS x1 range, and connect it across the analyzer's power cord. The meter should measure infinite resistance with S1 set to OFF, and about 160 ohms with S1 in the ON position. Next, connect one lead of the meter to the negative (or shield) terminal of J3, and touch the other lead to the shield connection of J1 and J2. The meter should read 0 ohms (dead short). Connect the meter across J1 and read the resistance—it should be about 50 ohms with S2 in the LOW position and 10k ohms with S2 in the HIGH setting. Switch the meter to the highest resistance range available (Rx1M on a VOM, or Rx20M on a DMM). Connect one meter lead to a blade on the power cord, switch S1 to the ON position, and touch J1, J2, and J3 with the other lead (be sure to check both the shield and the center contact). If a metal case was used, touch the case as well. The meter should read infinite resistance. Move the meter lead on the power cord to the other lug and repeat the above tests. Again, the meter should read infinite resistance. If the meter reads any resistance at all, stop and check the wiring. Do not proceed to the next step unless all the above tests check out correctly!

Plug the analyzer into a 120 volt outlet, and turn switch S1 on. Indicator lamp I1 should glow. Switch the VOM or DMM to read AC volts, and hook the leads across J3. About 6.5 volts should be present with S2 in the LOW position. Switching S2 to HIGH should cause the voltage to increase to approximately 13 volts. Connect the meter across J2—the same readings should be observed. Connect the meter across J1—it should read 0 volts. Now short the terminals at J3. The meter should indicate around 6.5 volts with S2 in LOW and around 13 volts with S2 set to HIGH range. If all readings were correct, the analyzer is working properly.

Analyze Any Situation

Now we're ready to put the component analyzer to work. Set up the oscilloscope for X-Y operation, and connect J1 to the scope's vertical input and J2 to the horizontal input, making sure the scope inputs are set to DC coupling. Do not use AC coupling, as the low frequency reactance of the scope's internal DC blocking capacitors may distort the wave form. Turn the analyzer on, set range switch

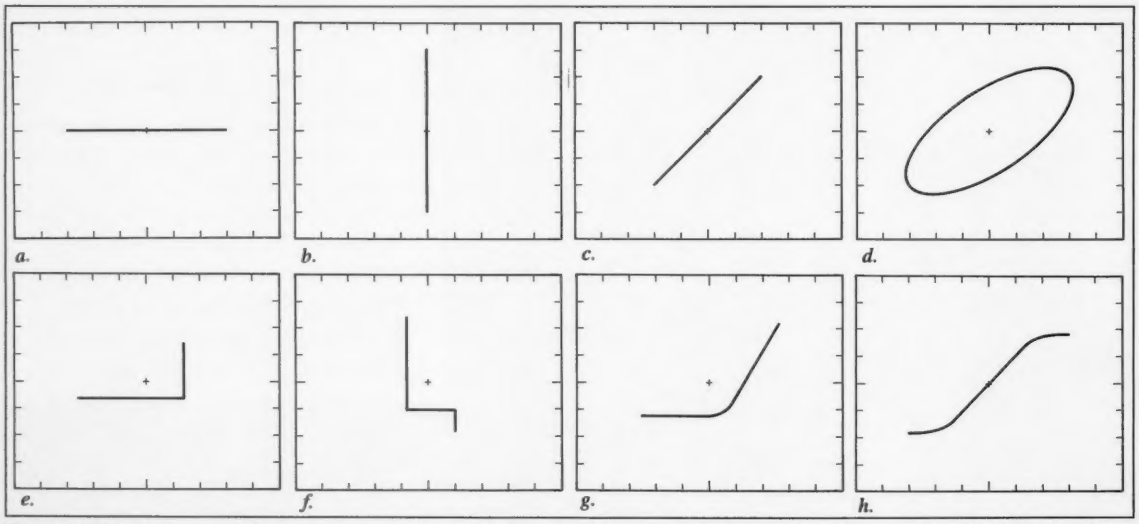


Figure 4. Typical component signatures: a. Open circuit; b. Short circuit; c. Resistor; d. Capacitor/inductor; e. Good P-N semiconductor junction; f. Zener diode; g. Leaky semiconductor junction; h. Non-linear resistance.

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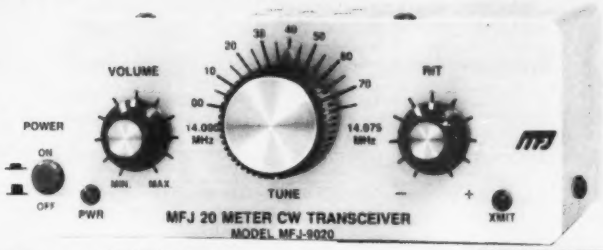

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True Receiver Incremental Tuning (RIT) lets you dodge QRM and compensate for drift without moving your transmit frequency.

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The MFJ-9020 is housed in an attractive matte-black aluminum enclosure with a deluxe brushed-aluminum front panel and matched knob set. Machine screws and pressed-in PEM nuts are used — not sheet metal screws.

Has power-on LED, transmit LED and SO-239 coax connector for antenna.

Designed by Rick Littlefield, K1BQT

The MFJ-9020 was designed by Rick Littlefield, K1BQT. He's known worldwide for his reliable high-performance transceiver designs and numerous papers.

K1BQT has given careful attention to board layout, heatsinking, mechanical rigidity, voltage regulation and component selection to ensure stable operation and long-term reliability.

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S2 to HIGH, and then switch the scope on. A horizontal line should appear on the CRT. Now short the test leads at J3, and the trace should become a vertical line (if these displays are reversed, swap the connection to the scope). Never turn the analyzer off with the scope on, as this will stop all trace sweep on the oscilloscope, and the resulting stationary spot could burn the CRT if left in place too long! Adjust the scope's input attenuators to obtain a nearly full-scale deflection on the CRT in both axes (about 5 volts per division). The actual attenuator setting or scope calibration is unimportant, since we are not interested in measuring absolute voltage or current values. The trace shape is the important thing.

The dynamic component analyzer can be used to test discrete components in or out of circuit, and can also be used to isolate defective stages in complicated circuits. To test components out of circuit, clip the component across the test leads at J3, and observe the waveform displayed on the oscilloscope. Small signal diodes, transistors, and IC chips are tested in LOW range, while power transistors and rectifiers should be tested using the HIGH range. Resistors, capacitors, and inductors can be tested on either range—simply select the range which gives the most detailed display. When testing capacitors, pay attention to the voltage rating, especially on electrolytics!

Testing components in circuit, or attempting to isolate a defective stage, requires a slightly different procedure. First and most important, do not attempt to use the analyzer on powered circuits! Always make sure the device under test is disconnected from its power source, or severe damage could occur to the analyzer, scope, or unit under test. This warning holds true for the commercial units as well. Dynamic component analyzers are not meant to be used on live circuits!

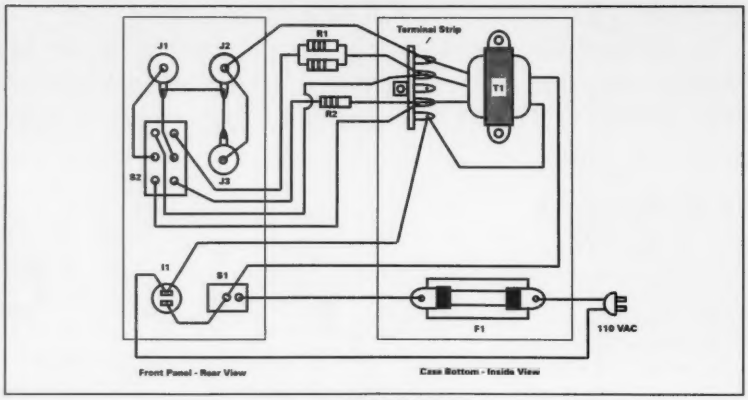

Figure 5. Wiring diagram.

Dynamic Component Analyzer Specifications

Maximum open-circuit test voltage:
- Low Range : 9.3 VAC peak (6.5 V RMS)
- High Range: 18.8 VAC peak (13 V RMS)

Maximum short-circuit current:
- Low Range : 123 mA rms
- High Range: 1.2 mA rms

Test Frequency: 60 Hz
Input voltage: 120 volts AC
Maximum input power consumption:
- Low Range : 1.8 watts
- High Range: 1 watt

Parts List for Active Component Tester

Qty.	Description	Symbol/RS#/Price
1	12.6V CT transformer	T1273-1365$4.29
1	6-foot AC power cord	P1278-1255$1.19
1	5-point lug strip	274-6884/$1.29
1	SPST toggle switch	S1275-624$2.29
1	DPDT toggle switch	S2275-626$2.59
1	neon lamp assembly	I1272-7052/$1.79
1	fuse holder	270-7392/$.99
1	120V, 1/4A fuse	F1270-12713/$.79
2	100 ohm, 1W resistor	R1*271-1522/$.29
1	10 k ohm, 1/2W resistor	R2271-0312/$.25
3	BNC chassis mount jack	J1-3278-105$1.39/ea.
1	plastic case	270-250$3.99

Total cost of project: $23.92

*Connect the two 100 ohm, 1 watt resistors in parallel to create the 50 ohm resistor needed for R1.

To properly test a component in circuit, a known-good "reference" circuit is required, since multiple current paths will tend to distort the analyzer signature. The test leads are alternately placed across identical points on the good and bad boards. Although the resulting pattern may not look anything like it should, the scope traces should be identical between the two boards. When identical test points produce different signatures, the technician has found the defective stage, and further comparison on a part-by-part basis should quickly weed out the defect. Although most readers don't have a spare TS-440S or IC-735 lying around, this is still a viable troubleshooting technique for audio equipment. Most faults with stereo components typically involve only one channel. Thus, the functional channel can be used as the reference for the bad channel!

Component Signatures

Most components under test will produce one of eight main types of traces, or signatures. An open circuit (Figure 4a) produces a horizontal line, while a dead short will produce a vertical trace (Figure 4b). A resistor will produce a diagonal line (Figure 4c), the angle of which will depend on the value of the resistor. Very low resistances will produce an almost vertical trace, while very high resistances will tilt the trace just slightly off the horizontal baseline. Capacitors and inductors cause the trace to appear as an oval (Figure 4d). The shape and angle will vary from a very narrow ellipse to a large, broad circle, depending on the actual value of the component under test. A good P-N semiconductor junction should appear as a right angle (Figure 4e)—a vertical line meeting a horizontal line at a very sharp, well defined 90 degree angle. A skewed vertical line, or a rounded, poorly defined intersection between the two lines (Figure 4g) indicates a leaky semiconductor junction. If the pattern appears reversed, or upside-down, don't worry, as it is a function of test lead polarity. A zener diode should produce a stair-step type pattern (Figure 4f). Again, it doesn't matter if the pattern appears upside-down from the example—the overall shape and definition of the right angles are the important things. Finally, a non-linear resistance will produce the trace shown in Figure 4h. Non-linear inductance and capacitance will produce a similar trace, except that it will appear as an ellipse instead of a line. Three terminal devices such as transistors are tested as three discreet P-N junctions. Hooking the test leads across the emitter and base, the base and collector, and finally the emitter and collector, should produce traces for a good P-N junction, a good P-N junction, and an open circuit, respectively. Although it may seem a bit complicated, the basic patterns are easily learned within a few hours. The quickest way to learn is to grab a handful of junk-box parts and observe the signatures each produces!

The prototype unit described in this article has been in use for a little over six months now, and has proven itself extremely useful, especially in testing semiconductors. I previously tested transistors with an industrial digital multimeter with a built-in diode test function. I was literally shocked to discover how many of my surplus junk box power transistors were actually bad! Although the DMM indicated all the devices were good, the component analyzer showed over 40% of the devices suffered from excessive emitter-collector leakage, poor junction performance, and gross non-linearities! And checking junctions with the analyzer is twice as fast as using the DMM, since there is no need to reverse the test leads for front-to-back comparisons! The tester has also weeded out a number of capacitors which were either leaky or exhibited excessive amounts of series resistance. All in all, the unit has easily paid for itself many times over. The prototype was so successful in the shack that I'm building a second unit for the work QTH!

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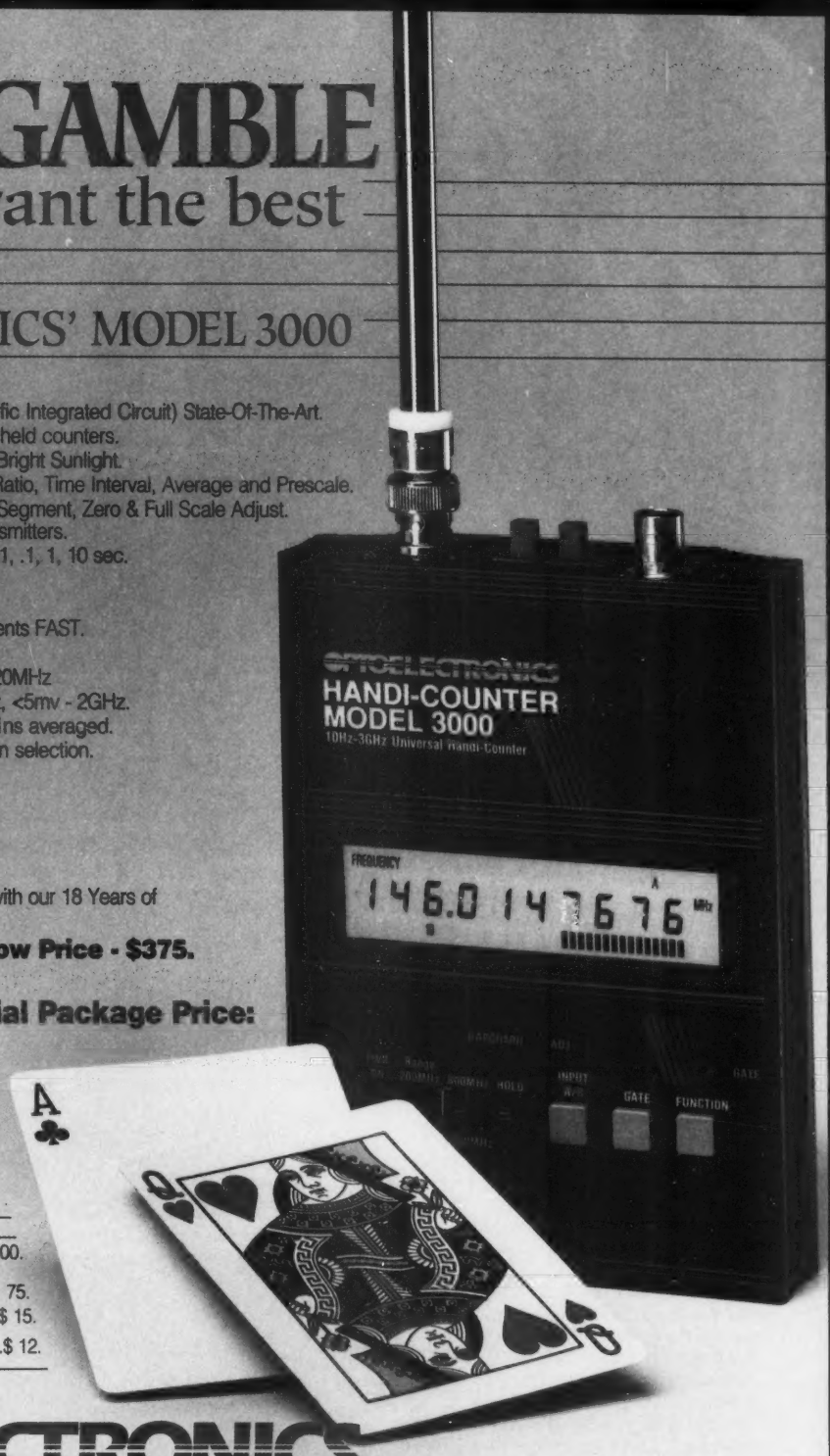

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Log Periodic Dipole Array for 2 Meters

Wideband performance in a small package.

by Dave Koslow N2KLK

I wanted an antenna for backpacking that would be very portable, very small, have high gain, a good f/b ratio, and cover the whole 2m band. Not a small wish list!

Consulting my trusty *ARRL Antenna Book*, I experimented with quads (too bulky and fragile), verticals/ground planes (low gain and not directional), and yagis (too big physically, and small bandwidth). Then I found what seemed to be my dream antenna—the Log Periodic Dipole Array. Never seen one? Just look at the roofs in your neighborhood—many TV antennas are LPDAs!

The LPDA

In these antennas the elements are all driven, and each half is fed 180 degrees out of phase with the other. The feedpoint is at the front of the antenna. All the characteristics, such as SWR, gain, f/b ratio, and pattern, are fairly constant over the entire operating bandwidth. This means you don't have to optimize the antenna for a small segment of the 2 meter band. You can work any mode anywhere in the 4 MHz range and expect consistent performance. At VHF and above, the feeders can double as the boom. This allows for simple, solid construction. While all elements are driven in this system, not all are active at any particular frequency. As the operating frequency changes, so does the area of the antenna that is resonant. The remaining elements act like reflectors and directors. (*The ARRL Antenna Book*, 15th Edition, pp. 10-1 to 10-7.)

With the help of a spreadsheet, scientific calculator, and lots of tea, I worked through the equations to optimize a design. Believe me, this is one antenna project where math had better be your friend!

I arrived at a 5-element design that gave 9 dB gain, about 15 dB f/b ratio, and all on a 2-foot boom! My finished antenna collapses to a bundle about 25″ x 1.5″ and weighs a little over a pound. Not too shabby, huh? Because of its small size, this is also an excellent "stealth" antenna for condos that don't like hams. It looks just like a tiny TV antenna. Its portability and high gain also make it perfect for emergency communications.

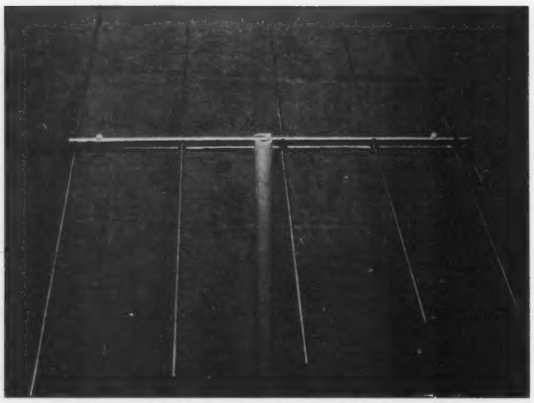

Photo A. Inside full view, horizontal polarization.

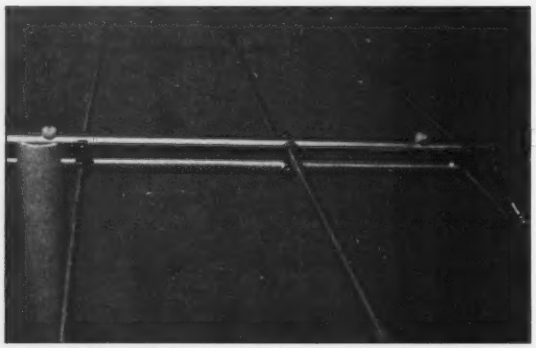

Photo B. Detail of the boom and element, horizontal polarization.

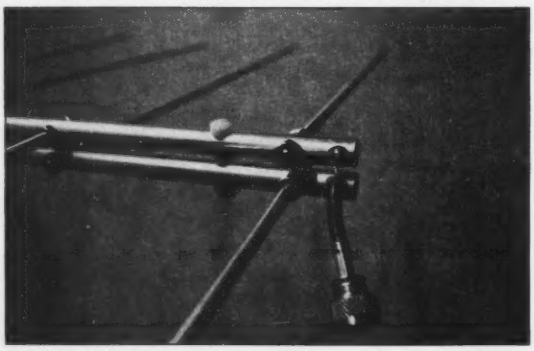

Photo C. Detail of the boom, element assembly and feedpoint attachment.

I built a prototype from plumbing pipe and old bits of TV antenna to prove out the design. Later, I made an interesting discovery—the prototype's performance was a close match for the final version that I machined!

My final antenna basically consists of two parallel feeders of 1/2″ aluminum tube and five sets of elements of 1/4″ aluminum rod. You should be able to find this in any good hardware store. The feeders are held together with a fixed gap by nylon hardware and washers. (Sets of nylon hardware, sufficient for two antennas, are available for $4 from: Dave Koslow N2KLK, 3315 Hamilton Rd., Fairlawn NJ 07410.)

Clearly, here is a case where measurement, not material, is important. I have included data on various element and feeder diameters so you can build one out of what you have at hand.

Construction

You will need some basic metal working tools and skills. Later in this article I have included some alternative suggestions for construction using simpler techniques.

Cut the two boom sections to 27″. You will need a drilling jig and drill press to make accurate holes. I made up a block of wood, slightly longer than the boom section, with a "V" notch about 3/8″ deep down the long axis. Lay the boom section in the groove and

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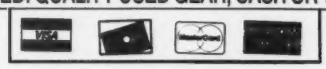

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RS-35M	POWSUP 12V, 25C, 35S W MTR	204.95	CALL
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AR-10	TEN-METER RINGO
AR-270	2M/70CM BASE VERTICAL
ARX-220B	220 MHz VERTICAL
ARX-2B	VHF 2M VERTICAL
AV3	HF 20/15/10M VERTICAL
AV5	ANT HF 80/40/20/15/10 VERTICAL
R5	HF 20/17/15/12/10 VERTICAL
R7	7, 10, 14, 18, 21, 24, 28M VERTICAL

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nconcepts

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2-217	144MHz AMP 2WIN 170WOUT	319.00	CALL
2-23	144MHz AMP 2WIN 30WOUT	133.00	CALL
2-317	144MHz AMP 30WIN 170WOUT	279.00	CALL
2-417	144MHz AMP 45WIN 170WOUT	279.00	CALL
2/70	DUAL 3–30W 2M/5–20W 440	239.00	CALL
2/70G	PREA 3–30W 2M/5–20W 440	269.00	CALL
3-112	220MHz 10WIN 120WOUT	319.00	CALL
3-211	220MHz 2WIN 110WOUT	319.00	CALL
3-32	220MHz AMP 2WIN 20WOUT	129.00	CALL
3-312	220MHz 30WIN 120WOUT	279.00	CALL
4-110	440MHz AMP 10WIN 100WOUT	369.00	CALL
4-310	440MHz AMP 30WIN 100WOUT	341.00	CALL
4-32	440MHz AMP 3WIN 20WOUT	178.00	CALL
RFC-2/70	DUALBAND AMP 5WIN 25WOUT	269.00	CALL

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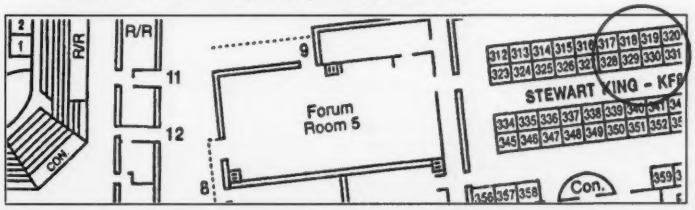

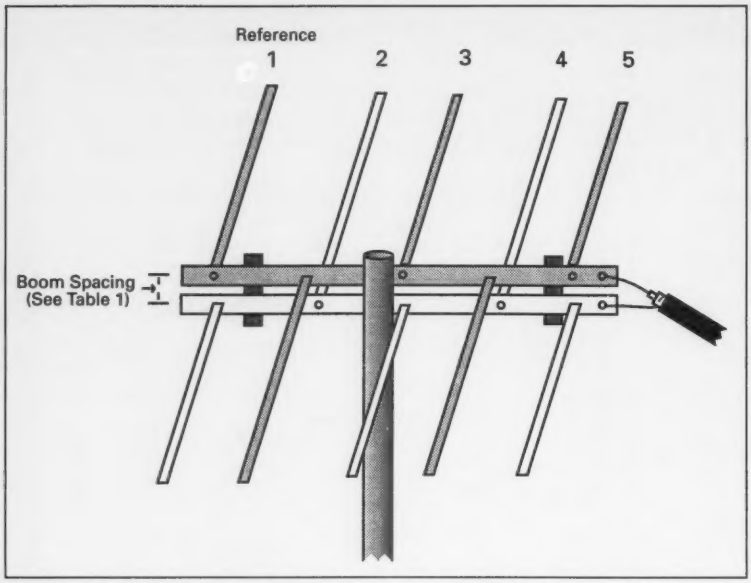

Figure 1. Construction details of the LPDA antenna. Note that the feedpoint is located ½" in front of the shortest element pair.

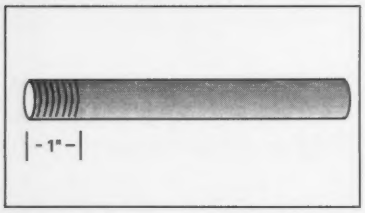

Figure 2. Cut each element 1-1/4" longer than shown in Table 1. Then cut a 1" length of screw threads on one end of each element using a 1/4-20 tap and die set.

scribe a line down its length with a pencil, using the block surface as a guide. This will be your drilling line.

Now rotate the tube so that the line is perpendicular to the block. Drill a small hole at each end of the boom section and secure the boom to the block with a small screw. Now lay out the hole spacing, starting with the first hole about 1-1/4" from an end. The measurements for hole spacing and element length are given in metric terms for greater accuracy. Mark each point with a center punch or hammer and nail to prevent drill skip. Drill and tap each hole for a 1/4-20 thread. These are for the elements to screw into. Drill a small hole, about 1/2" forward of the smallest element. This will be the feedpoint. Remove the boom from the jig, rotate 90 degrees, then secure it again with small holes and screws at the ends. Now drill three 1/4" clearance holes, at about 3", 13" and 23" from the longest element end. These are for securing the two boom halves. Repeat the process for the second section. Cut off the excess boom material, about 1/4" behind the longest element, and 1/4" in front of the feedpoint. Assemble the two boom sections together with nylon hardware and sufficient washers to provide the specified gap. The two halves must be insulated from each other, as they are the active parts of the feeder.

Cut each element about 1-1/4" longer than the finished size to allow for threading and tuning. Using a 1/4-20 die, cut about 1" of threads on one end of each rod element (see Figure 2). Put a nut on each element, spinning it down to the bottom of your threaded section, and tighten it in place with a wrench. In a LPDA, the feedpoint is at the front of the antenna, so the smallest element goes here. Each element half is screwed in to the boom, alternating top-left to bottom-right for the first element, top-right-to-bottom-left for the second, and so on (see the photos and Figure 1). This is to give a 180 degree phase shift to each pair. Attach a nut, finger-tight, to the element segment protruding from the boom. Measure each element length from the boom center and file or grind off the excess. Do the same with the threaded element past the nut. To attach the feedline, solder the conductor and shield to small brass washers and secure to the boom with brass hardware.

Specifications

Frequency range: 144–148 MHz
Gain: 9 dB
F/B ratio: 15 dB
Half-power beamwidth: 25 degrees
SWR: <1.5:1
Boom length: 25"
Longest element: 41+" (total)
Packed size: 25" x 1.5"

Finished Element Halves (2 of each)		Element Spacing
Element 1	52.44 cm (20.65")	Reference
Element 2	48.50 cm (19.10")	16.78 cm (6.61")
Element 3	44.86 cm (17.66")	15.52 cm (6.11")
Element 4	41.50 cm (16.34")	14.36 cm (5.65")
Element 5	38.39 cm (15.11")	13.28 cm (5.23")

Boom Spacing (Center-to-Center)	
0.500" boom & 0.250" element	0.614" spacing
0.500" boom & 0.375" element	0.652" spacing
0.625" boom & 0.250" element	0.767" spacing
0.625" boom & 0.375" element	0.815" spacing

Table 1. Log periodic dipole array specifications.

Alternatives

There are many ways to construct a LPDA. My two antennas were radically different in construction style and both work fine. In my prototype, the elements were 3/8" aluminum rolled tubes from an old TV antenna, held in to a copper tube boom with sheet metal screws. The boom insulators were PVC pipe welded together.

If you can't find aluminum tubing, 1/2" copper tubing works just fine. Because of the difference in diameter (it is really 0.625" o.d.), the antenna requires a different spacing of the boom halves. See Table 1 for the specifications. If you don't have access to metal shop tools, try contacting a local high school industrial arts shop. Surely a little fast talking (and maybe a ham radio demo) can get a few pieces threaded and drilled. You could also try using plain aluminum rod with speed nuts instead of threads. This will make portability a bit tough, though. Another possibility is threaded steel rod for the elements. Use your imagination—the dimensions and spacings are all that is critical.

Mounting is somewhat an individual thing, but there are some guidelines to follow. Because the whole antenna is active, it doesn't like metal masts too close. This is especially true with vertical polarization. You should have a nonconductive mast at least 10" beyond the longest element tip before a metal mast. I use a 3' PVC pipe on a small metal mast for backpacking DX. The antenna rests in a slot at the top and is held in place by a slotted PVC end cap. One end has a slot for vertical polarization; the other end is horizontal. This works pretty well for temporary setups. I haven't worked much on a permanent installation. Whatever you come up with, make sure you don't short the two boom halves together. If performance (or SWR) is poor, check that the elements are in proper order, and alternating left-to-right and top-to-bottom. It is very easy to make a mistake, so check carefully. This has "got" me several times in the hills.

I have had great success with this antenna, on repeaters and SSB, everywhere from mountaintops to my back yard. Try it. I think it will be the best portable antenna you've ever had.

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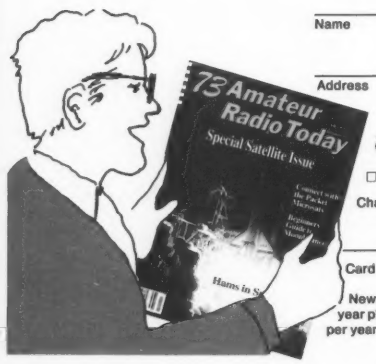

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QRP Sidetone Companion

And part-time code practice oscillator.

by Charles D. Rakes KI5AZ

If you're a QRP enthusiast who enjoys building and operating small QRP transmitters, and you're doing so without the benefit of a built-in sidetone generator, take a look at our QRP Sidetone Companion and part-time code practice oscillator. This inexpensive, easy-to-build project can add a pleasant sidetone to almost any QRP transmitter, and serve double duty as a code practice oscillator for a soon-to-be ham.

Five transistors, a few capacitors and resistors, and an IC occupy a small PC board measuring 7/8" x 2-1/4". All of this along with an on/off switch, two phono jacks, a speaker, and a 9-volt battery, share space in a small plastic cabinet from Radio Shack. If you don't have a junk box to scrounge from, you can end up with ten dollars or less in the project by prudent component shopping.

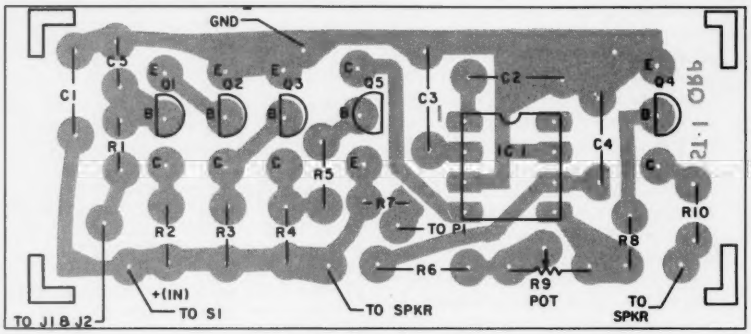

Figure 3. Parts placement.

The Inner Workings

To see how the circuit goes, take a look at the schematic diagram in Figure 1. The circuit is designed to operate with most any QRP transmitter that uses a positive keying voltage (most do). Two phono jacks are wired in parallel with the center conductors connecting to the base of Q1 through a 680k resistor. C5 eats any stray RF that might come in on the key leads. The positive keying voltage turns Q1 on. The emitter of Q1 is direct coupled to the base of Q2, turning it on also. Q3 is direct coupled to the collector of Q2, and when Q2 is on, Q3's base is clamped to near ground level, turning it off. With no current flow through R4, Q5 remains off.

By closing the key, the positive voltage at the base of Q1 disappears, turning Q1 and Q2 off; this allows Q3 and Q5 to turn on, bringing up the plus supply voltage to pin #4 of the 567 PLL IC. The 567, connected in an audio oscillator circuit, produces an audible tone signal that drives Q4. Q4's collector supplies audio to the speaker through a current-limiting resistor, R8. R9 sets the sidetone's frequency.

Three transistors are used in the front end to isolate the sidetone's circuitry from loading and falsely keying the QRP transmitter. For even greater isolation, R1 can be increased to 1 megohm. This will only be necessary if the sidetone circuit is used with a super-sensitive keying circuit—which isn't likely, but with Mr. Murphy lurking around every corner, anything is possible.

The part-time code practice oscillator is activated by inserting P1 into either J1 or J2, and a key in the remaining jack. If you like to fiddle with the sidetone's frequency, drill a 1/4" hole in the cabinet directly over R9, and adjust away.

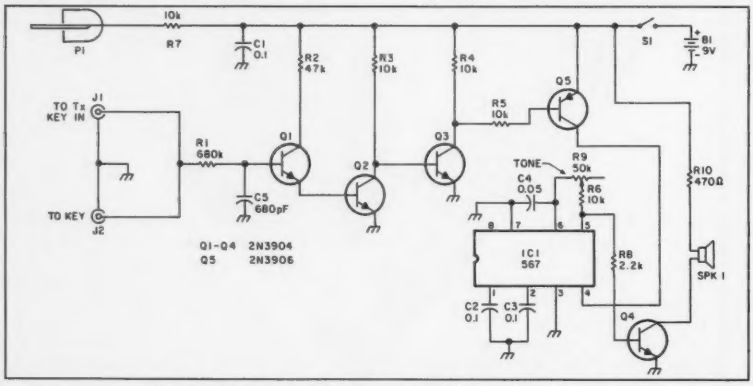

Figure 1. Schematic diagram of the Sidetone Companion.

Building the Sidetone Companion

The easy way is to use a PC board and follow the component placement drawing in Figure 2. As you position each part on the board, double-check its value and electrical location against the circuit diagram in Figure 1. In any case, the circuit is non-critical, and can be built breadboard style and housed in anything you like.

The circuit board is cut to slide into the groove in the side of the cabinet. The telephone headset (speaker) is located at one end of the cabinet, hot-glued in place. The power switch, the two phono jacks, and the plug are located along one edge of the cabinet. The battery fills the other end. Using the companion, plug the key into one of the jacks and run a jumper from the other jack to the "key" input of the transmitter. Flip S1 on, and hear what you are sending. Good QRPing! 73

Charles D. Rakes KI5AZ, P.O. Box 445, Bentonville AR 72712.

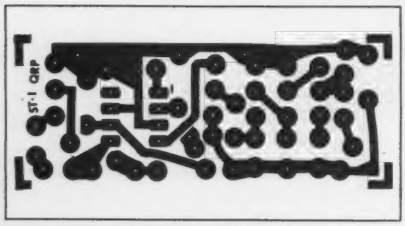

Figure 2. PC board foil pattern.

Parts list

B1	9-volt transistor battery	R8	2.2k 1/4W resistor
C1,2,3	0.1 µF 50-volt disc ceramic capacitor	R9	50k mini trim pot (vert)
C4	0.05 µF 100-volt mylar capacitor	R10	470-ohms 1/4W resistor
C5	680 pF 100-volt disc ceramic	S1	Mini SPST toggle switch
Q1,2,3,4	2N3904 NPN transistor	Spk-1	Headset removed from old telephone or a mini 8- or 16-ohm speaker
Q5	2N3906 PNP transistor	Misc.	Cabinet, wire, battery snap, hot glue, etc.
IC-1	567 PLL IC		
J1,2	Phono jacks		
P1	Phono plug		
R1	680k 1/4W resistor		
R2	47k 1/4W resistor		
R3,4,5,6,7	10k 1/4W resistor		

A printed circuit board and all of the parts for it are available for $8.95 plus $1.00 shipping from: KRYSTAL KITS, P.O. Box 445, Bentonville AR 72712. Tel. (501) 273-5340. You will need to furnish the cabinet, switch, jacks, plug, speaker, battery, and any part not on the PC board.

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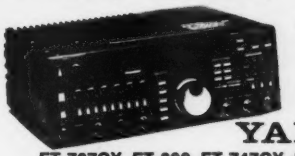

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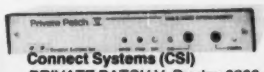

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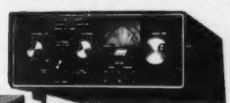

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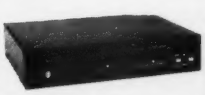

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CIRCLE 41 ON READER SERVICE CARD

The Copperback Beetle

A new type of "bug."

by Charles D. Rakes KI5AZ

In the May 1991 issue of *73 Amateur Radio Today*, I introduced the "Copperhead" keyer paddle that electronically replaces a mechanical paddle. Just a few days after the magazine came out, a fellow ham, Floyd Deen AA5QY, asked if I could design an electronic replacement for the cantankerous "Bug" keyer. Here are the results.

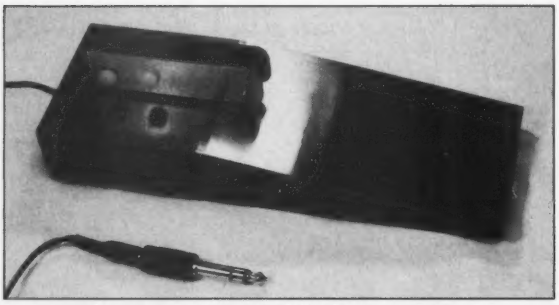

Photo A. The Copperback Beetle electronic bug.

The "Copperback Beetle" performs like the famous Bug—happily generating dits automatically, with the last dit a twin of the first, no matter how many are in between. Also, the built-in dit generator is self-completing. Dahs are produced like the Bug—for as long as you like. And, like the Copperhead Keyer, the Beetle is touch-activated and will operate most commercial solid-state rigs with positive keying.

The Beetle is an excellent trainer for anyone who wants to learn to use the mechanical Bug because you can slow the dit maker to a snail's pace, or rack it up to a machine-gun-like speed. If you've been up to your Adam's apple with dits trying to master a Bug, then give the Copperback Beetle a shot. You might even like its feather touch.

Circuit Operation

Look at the Beetle's schematic diagram in Figure 1. See how few electronic components are needed to replace the many monkey-motion mechanical parts used in a typical bug. Also notice that an on/off switch isn't needed because the standby current is almost nonexistent. At rest, the battery will stay up for its normal shelf life.

The heart of the beetle is a single 4093 CMOS quad two-input NAND Schmitt trigger IC. The "dit" (left) paddle is connected to the input of gate "A" through a 100k resistor, and on to the positive voltage at the output of pin #10 of gate "C," through four series 10 megohm resistors. The minute current flow through the 40 megohm resistors holds the gate's input high. In standby the gate's output, pin #3, is low. When your skin resistance bridges the paddle-to-circuit ground, the gate's output goes positive, starting the dit generator, which is made up of gates "C" and "D." The self-completing function is accomplished when the output of gate "C" (pin #10) goes low, holding the dit input circuitry low for the time duration of the dit. The positive output at pin #11 of gate "D" passes through D2, turning on Q1 to activate the keyed output during the dit period.

The "dah" (right) paddle circuit operates in a similar manner, with the positive output at pin #4 of gate "B" passing through D1, switching Q1 on to supply a keyed output. A 39 pF capacitor at the input of both the "A" and "B" gates routes any stray RF to circuit ground.

Building the Beetle

The Beetle uses the very same hardwood base and paddle setup as the Copperhead keyer used (see Figures 2 and 3). The circuit can be constructed breadboard style or, to make the job easier, with a PC board. However you build it, take special care in handling and installing the CMOS chip.

Woodworks

Shape the keyer's base out of a hardwood block 3" x 8-1/2" x 1-1/4", as shown in

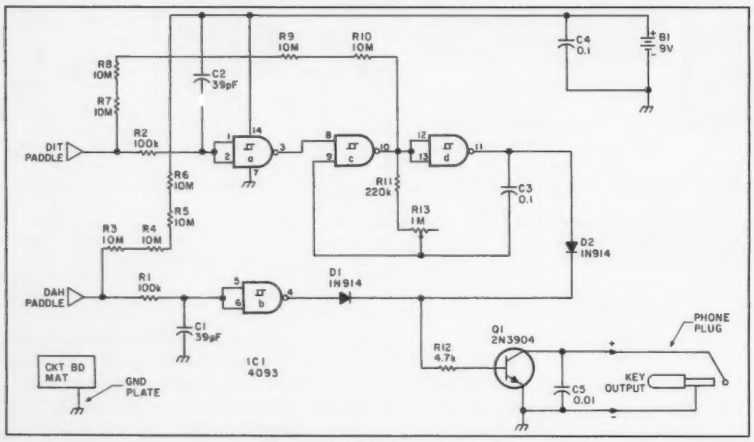

Figure 1. Schematic diagram.

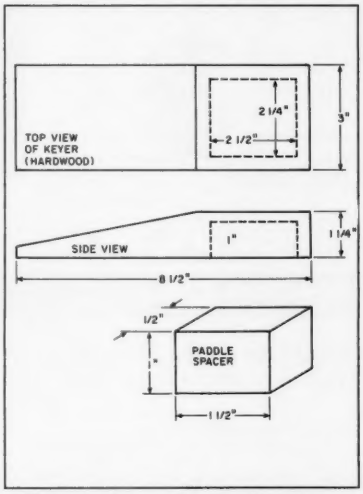

Figure 2. Keyer and spacer dimensions.

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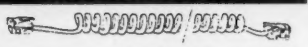

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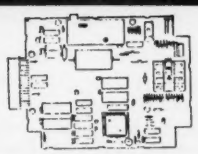

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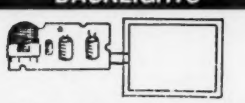

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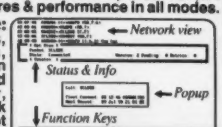

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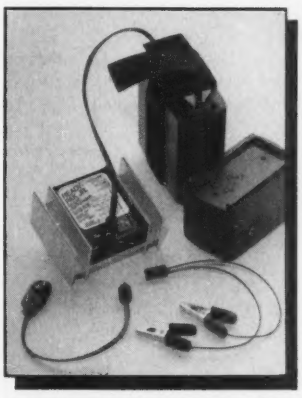

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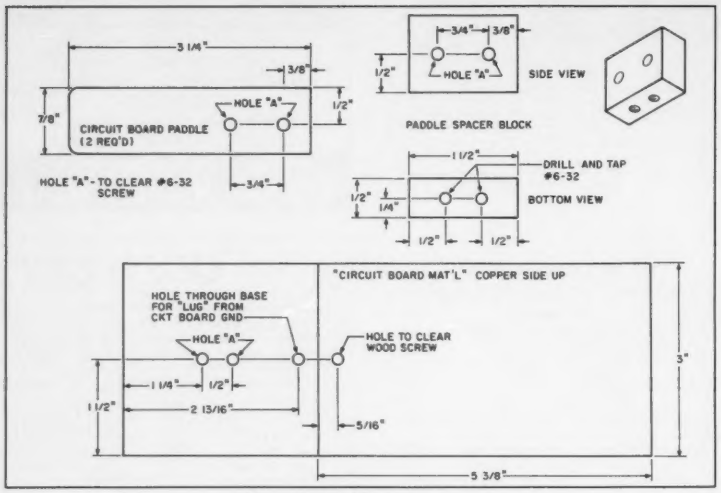


Figure 3. Paddle dimensions.

Figure 2. Carve a 2-1/2" long by 2-1/4" wide by 1" deep cavity in the base to hold the circuit board and battery.

Cut a paddle spacer from the same hardwood material to the dimensions shown in Figure 2. Cut two paddles from circuit board material to the size and shape shown in Figure 3. Drill two holes in each paddle to match up with the two holes in the spacer block, then use a file or belt sander to round the corners of one end of each of the paddles. Smooth the edges with fine grit sandpaper.

Now you can drill the paddle mounting holes through the side of the spacer block as shown, and then drill two holes in the bottom of the spacer. Thread each for a 6-32 metal screw. Drill four holes in the base, then mount the spacer board in place with two 5/8" 6-32 screws.

The grounding board, a section of circuit board 5-3/8" x 3", is mounted to the keyer's base with glue and a single wood screw. A long solder lug extends from the wood screw through a hole in the base (see photo of the completed key) to the cavity where it connects to circuit ground.

The paddles are mounted to the spacer with nylon 6-32 screws and nuts. A long solder lug on each paddle is secured by the nylon hardware and extends through the base connecting to the circuit, as shown in Figure 1.

Figure 5 shows the component side of the circuit board and the parts placement. Mount the parts as shown and solder them in place. Then connect the paddles, grounding pad, battery snap, and output plug wires to the circuit board.

Mount the circuit board, with the 1 megohm pot towards the back, to the inside of the cavity with two 1/4" plastic spacers and wood screws. The battery is kept in place with an "L" bracket made from a spring steel 9 volt battery holder, and is mounted to the edge of the cavity with a wood screw.

Copperback Beetle Parts List

B1	9-volt transistor battery
C1,C2	39 pF ceramic disc cap
C3,C4	0.1 µF ceramic disc cap
C5	0.01 µF ceramic disc cap
D1,D2	1N914 silicon diodes
IC-1	4093 quad 2-input NAND Schmitt trigger
Q1	2N3904 NPN transistor
R1,R2	100k 1/4 watt resistors
R3–R10	10 megohm 1/4 watt resistors
R11	220K 1/4 watt resistor
R12	4.7k 1/4 watt resistor
R13	1 megohm pot
Phono plug	mini or standard 1/4"
Misc.:	Hardwood material, circuit board material, battery snap, nylon hardware, solder lugs, wire, solder, etc.

You can buy a complete kit of parts, including a shaped base and spacer ready for stain or paint, paddles, hardware, circuit board, and all components, postpaid for $29.95 from Krystal Kits, P.O. Box 445, Bentonville AR 72712.

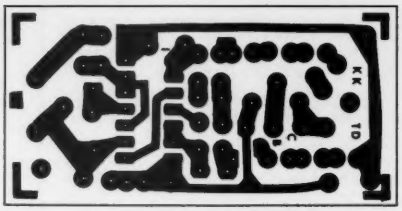


Figure 4. PC board foil pattern.

Checking the Beetle Out

With a battery in place, take a VOM in the RX-1 position and connect the positive lead (don't rely on red to mean positive; check it out) of the meter to the tip of the keyer's output plug, and the meter's negative lead to the common sleeve on the plug.

Position your wrist on the grounding pad and touch the "dit" (left) paddle. The meter should go from infinite resistance to approximately half-scale, and wiggle back and forth at the dit rate. Adjust R13 for the desired dit rate. Now touch the "dah" (right) paddle and the meter should go from infinite resistance to near zero. If so, you're ready to dit dah in style.

Contact Charles D. Rakes KI5AZ at P.O. Box 445, Bentonville AR 72712. Please enclose an SASE.

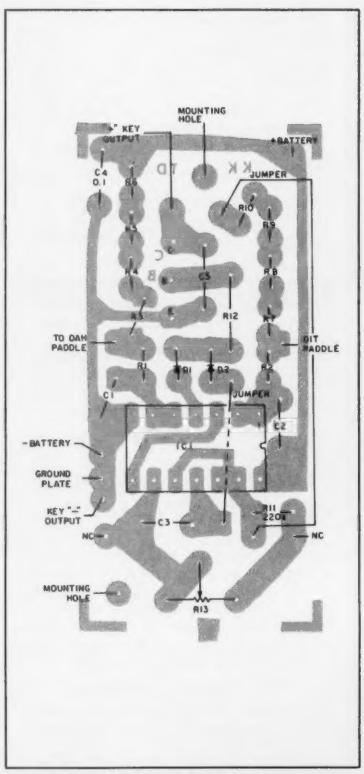


Figure 5. PC board parts placement.

RAMSEY ELECTRONICS

COM-3
$279.95

2 WAY RADIO SERVICE MONITOR

COM-3, the world's most popular low-cost service monitor. For shops big or small, the COM-3 delivers advanced capabilities for a fantatic price—and our new lease program allows you to own a COM-3 for less than $3.00 a day. Features •Direct entry keyboard with programmable memory •Audio & transmitter frequency counter •LED bar graph frequency/error deviation display •0.1–10.000 µV output levels •High receive sensitivity, less than 5 µV •100 kHz to 999.9995 MHz •Continuous frequency coverage •Transmit protection, up to 100 watts •CTS tone encoder, 1 kHz and external modulation.

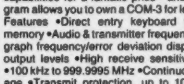
RSG-10
$249.95

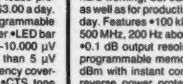
SYNTHESIZED SIGNAL GENERATOR

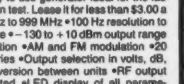
Finally, a low-cost lab quality signal generator—a true alternative to the $7,000 generators. The RSG-10 is a hard working, but easy to use generator ideal for the lab as well as for production test. Lease it for less than $3.00 a day. Features •100 kHz to 999 MHz •100 Hz resolution to 500 MHz, 200 Hz above • – 130 to + 10 dBm output range •0.1 dB output resolution •AM and FM modulation •20 programmable memories •Output selection in volts, dB, dBm with instant conversion between units •RF output reverse power protected •LED display of all parameters—no analog guesswork!

FREQUENCY COUNTERS

CT-70 7 DIGIT 525 MHz | **CT-90 9 DIGIT 600 MHz** | **CT-125 9 DIGIT 1.2 GHz**







Ramsey Electronics has been manufacturing electronic test gear for over 10 years and is recognized for its lab quality products at breakthrough prices. All of our counters carry a full one-year warranty on parts and labor. We take great pride in being the largest manufacturer of low-cost counters in the entire U.S.A. Compare specifications. Our counters are full-featured, from audio to UHF, with FET high impedance input, proper wave shaping circuitry, and durable high quality epoxy glass plated-thru PC board construction. All units are 100% manufactured in the U.S.A. All counters feature 1.0 ppm accuracy.

NEW CT-250 2.5 GHZ

ACCESSORIES FOR COUNTERS

Telescopic whip antenna—BNC plug, WA-10	$11.95
High impedance probe, light loading, HP-1	$16.95
Low-pass probe, audio use, LP-1	$16.95
Direct probe, general purpose use, DC-1	$16.95
Tilt bail, elevates counter for easy viewing, TB-70	$ 9.95
Rechargeable internal battery pack, BP-4	$ 8.95
CT-90 oven timebase, 0.1 ppm accuracy, OV-1	59.95

ALL COUNTERS ARE FULLY WIRED & TESTED

MODEL	FREQ. RANGE	SENSITIVITY	DIGITS	RESOLUTION	PRICE
CT-50	20 Hz–600 MHz	< 25 mV to 500 MHz	8	1 Hz, 10 Hz	$189.95
CT-70	20 Hz–550 MHz	< 50 mV to 150 MHz	7	1 Hz, 10 Hz, 100 Hz	$139.95
CT-90	10 Hz–600 MHz	< 10 mV to 150 MHz < 150 mV to 600 MHz	9	0.1 Hz, 10 Hz, 100 Hz	$169.95
CT-125	10 Hz–1.25 GHz	< 25mV to 50 MHz < 15 mV to 500 MHz < 100 mV to 1 GHz	9	0.1 Hz, 1 Hz, 10 Hz	$189.95
CT-250	10 Hz–2.5 GHz typically 3.0 GHz	< 25 mV to 50 MHz < 10 mV to 1 GHz < 50 mV to 2.5 GHz	9	0.1 Hz, 1 Hz, 10 Hz	$249.95
PS10B Prescaler	10 MHz–1.5 GHz, divide by 1000	< 50 mV	Convert your existing counter to 1.5 GHz		$89.95

SPEED RADAR $69.95 complete kit SG-7

New low-cost microwave Doppler radar kit "clocks" cars, planes, boats, horses, bikes or any large moving object. Operates at 2.6 GHz with up to 1/4 mile range. LED digital readout displays speed in miles per hour, kilometers per hour or feet per second! Earphone output allows for listening to actual doppler shift. Uses two 1-lb coffee cans for antenna (not included) and runs on 12 VDC. Easy to build—all microwave circuitry is PC stripline. ABS plastic case with speedy graphics for a professional look. A very useful and full-of-fun kit.

BROADBAND PREAMP

Boost those weak signals to your scanner, TV, shortwave radio or frequency counter. Flat 25 dB gain, 1 to 1000 MHz. 3 dB NF. BNC connectors. Runs on 12 VDC or 110 VAC.
PR-2, wired, includes AC adapter $59.95

2M POWER AMP

Easy to build power amp has 8 times power gain, 1W in, 8W out, 2W in, 16W out, 5W is for 40W out. Same amp as featured in many ham magazine articles. Complete with all parts, less case and T-R relay.
PA-1, 40W pwr amp kit $34.95
TR-1, RF sensed T-R relay kit . $ 9.95

FM WIRELESS MIKE KITS

FM-3 SHOWN

Pick the unit that's right for you. All units transmit stable signal in 88–108 MHz FM band up to 300' except for hi power FM-4 that goes up to ½ mile.
FM-1, basic unit ..... $ 5.95
FM-2, as above but with added mike preamp ..... $ 7.95
FM-4, long range, high power with very sensitive audio section, picks up voices 10' away $14.95
FM-3, complete unit includes case, battery, switch, antenna, and built-in condensor mike. Excellent fidelity, very small, kit $18.95
FM-3WT, as above, but fully wired and tested $19.95
SMC, miniature sensitive mike cartridge for FM-1, 2, 4 ..... $ 2.95

MICROWAVE INTRUSION ALARM

A real microwave Doppler sensor that will detect a human as far as 10 feet away. Operates on 1.3 GHz, and is not affected by heat, light, or vibrations. Drives up to 100 mA output, normally open or closed, runs on 12 VDC.
Complete kit MD-3 . $19.95

MUSIC MACHINE

Neat kit that will produce 25 different classical and popular tunes, plus 3 doorchime sounds. Lots of fun for doorbells, shop, or store entrances, car horn, music boxes, etc. Runs on 9V battery or wall transformer. Excellent speaker volume and adjustable tempo and pitch. Add our case set for a handsome finished look.
Complete kit, MM-5 ..... $24.95
Case + knob set, CMM-5 . $12.95

PACKET RADIO

Two new versions are available for the Commodore 64 (P-64A) or the IBM-PC (P-IBM). Easy assembly "NO TUNING". Includes FREE disk software, PC Board and Full Documentation.

KIT	P-64A	$59.95
	P-IBM	$59.95
CASE	CPK	$12.95

LO NOISE PREAMPS

Make that reciever come ALIVE! Small size for easy installation with Hi-Q tuned input for peak performance. Excellent gain and noise figure—guaranteed to improve reception! Specify band: 2M—PR-10, 220 MHz—PR-20, 440 MHz—PR-40.
Each kit $17.95

TONE DECODER

A complete tone decoder on a single PC board. Features: 400–5000 Hz adjustable range via 20-turn pot, voltage regulation, 567 IC. Useful for touch-tone burst detection, FSK, etc. Can also be used as a stable tone encoder. Runs on 5 to 12 volts.
Complete kit, TD-1 . $5.95

VOICE ACTIVATED SWITCH

Voice activated switch kit provides switched output with current capability up to 100 mA. Can drive relays, lights, LED, or even a tape recorder motor. Runs on 9 VDC.
VS-1 kit. $6.95

TELEPHONE TRANSMITTER

Mini-sized with professional performance. Self-powered from phone line, transmits in FM broadcast band up to ¼ mile. Installs easily anywhere on phone line or inside phone!
PB-1 kit $14.95

NEW—SPEAKER PHONE

Talk on the phone hands-free, great to put in shop or shack, press the button to answer—no actual phone needed. Works same as commercial units. Talk from anywhere in room, phone line powered—no battery needed. Super for family and conference calls or buy two for hands-free intercom! Add our case set for a pro look.
SP-1 ..... $29.95 Case-CSP $12.95

TICKLE STIK

A shocking kit! Blinking LED attracts victims to pick up innocent-looking can—you watch the fun! Ideal for office desks, parties, nosey know-it-alls!
TS-4 kit $9.95

LIGHT BEAM COMMUNICATORS

Transmits audio over infrared beam up to 30'—use simple lenses to go up to ¼ mile! Hum free, uses 30 kHz carrier. Great for wireless earphones or undetectable "bug."
Transmitter + receiver set, LB56 . $19.95

FM RADIO

Full-fledged superhet, microvolt sensitivity, IC detector and 10.7 MHz IF. Tunes Std. FM broadcast band as well as large portions on each end. Ideal for "bug" receiver, hobby experiments or even as FM radio!
FR-1 kit $14.95

SUPER SLEUTH

A super sensitive amplifier which will pick up a pin drop at 15 feet! Great for monitoring baby's room or as general purpose amplifier. Full 2W rms output. Runs on 6 to 15 volts, uses 8–45 ohm speaker.
BN-9 kit $5.95

BROADBAND PREAMP

Very popular sensitive all-purpose preamp, ideal for scanner, TVs, VHF/UHF rigs, counters. Lo noise, 20 dB gain, 100 kHz–1 GHz, 9V–12 VDC operation.
SA-7 kit $14.95

FANTASTIC FM TRANSCEIVERS

SYNTHESIZED—NO CRYSTALS

•2 METERS
•223 MHz
•440 MHz

$149.95

Ramsey breaks the price barrier on FM rigs! The FX is ideal for shack, portable or mobile. The wide frequency coverage and programmable repeater splits makes the FX the perfect rig for Amateur, CAP or MARS applications. Packeteers really appreciate the dedicated packet port, "TRUE-FM" signal and almost instant T/R switching. High speed packet? . . . . No problem. Twelve diode programmed channels, 5W RF output, sensitive dual conversion receiver and proven EASY assembly. Why pay more for a used foreign rig when you can have one AMERICAN MADE (by you) for less. Comes complete less case and speaker mike. Order our matching case and knob set for that pro look.

FX-146 kit (2 Meters)	$149.95
FX-223 kit (1¼ Meters)	$149.95
FX-440 kit (3/4 Meters)	$169.95
CFX matching case set	$ 24.95

2 MTR & 220 BOOSTER AMP

Here's a great booster for any 2 meter or 220 MHz hand-held unit. These power boosters deliver over 30 watts of output, allowing you to hit the repeater's full quieting while the low noise preamp remarkably improves reception. Ramsey Electronics has sold thousands of 2 meter amp kits, but now we offer completely wired and tested 2 meter, as well as 220 MHz, units. Both have all the features of the high-priced boosters at a fraction of the cost.

PA-10 2 MTR POWER BOOSTER (10 X power gain)
Fully wired & tested $89.95

PA-20 220 MHz POWER BOOSTER (8 X power gain)
Fully wired & tested $89.95

QRP TRANSMITTERS

20, 30, 40, 80M CW TRANSMITTERS

Join the fun on QRP! Thousands of these mini-rigs have been sold and tons of DX contacts have been made. Imagine working Eastern Europe with a $30 transmitter—that's ham radio at its best! These CW rigs are ideal mates to the receivers at right. They have two-position variable crystal control (one popular QRP XTAL included), one watt output and built-in antenna switch. Runs on 12VDC. Add our matching case and knob set for a handsome finished look.
Your choice of bands $29.95
(Specify band: QRP-20, 30, 40 or 80)
Matching case & knob set, CQRP $12.95

HAM RECEIVERS

20, 30, 40, 80M All Mode RECEIVERS

Build your own mini ham station. Sensitive all-mode AM, CW, SSB receivers use direct conversion design with NE602 IC as featured in QST and ARRL handbooks. Very sensitive varactor tuned over entire band. Plenty of speaker volume. Runs on 9V battery. Very EASY to build, lots of fun and educational—ideal for beginner or old pro. New 30-page manual. Add the case set for well-fitted professional look.
Your choice of bands $29.95
(Specify band: HR-20, HR-30, HR-40, HR-80)
Matching case & knob set, CHR $12.95

E-Z KEY CMOS KEYER

Send perfect CW within an hour of receiving this kit! Easy-to-build kit has sidetone oscillator, speed control and keys most any transmitter. Runs for months on a 9V battery. 28-page manual gives ideas on making your own key for extra savings. Add our matching case set for complete station look.
CW-7 kit $24.95
Matching case knob set, CCW $12.95

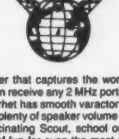
ACTIVE ANTENNA

Cramped for space? Get longwire performance with this desktop antenna. Properly designed unit has dual HF and VHF circuitry and built-in whip antenna, as well as external jack. RF gain control and 9V operation makes unit ideal for SWLs, traveling hams or scanner buffs who need hotter reception. The matching case and knob set gives the unit a hundred dollar look!
AA-7 Kit $24.95
Matching case & knob set, CAA $12.95

SPEECH SCRAMBLER

Communicate in total privacy over phone or radio. Kit features full duplex operation using frequency inversion. Both mike and speaker or line in/out connections. Easy hookup to any radio, and telephone use requires no direct connection! Easy to build 2 IC circuit. Can also be used to descramble many 2-way radio signals. Finish your kit off with the handsome case & knob set.
SS-7 kit $29.95
Matching case & knob set, CSS $12.95

SHORTWAVE RECEIVER



Fantastic receiver that captures the world with just a 12" antenna! Can receive any 2 MHz portion from 4–11 MHz. True superhet has smooth varactor tuning, AGC, RF gain control, plenty of speaker volume and runs on a 9V battery. Fascinating Scout, school or club project provides hours of fun for even the most serious DXer. For the car, consider our shortwave converter. Two switchable bands (in 3–22 MHz range), each 1 MHz wide—tunable on your car radio dial. Add some interest to your drive home!
Shortwave receiver kit, SRI $27.95
Shortwave converter kit, SCI $27.95
Matching case set for SRI, CSR $12.95
Matching case set for SCI,CSC $12.95

2, 6, 10 MTR, 220 FM RECEIVERS

Keep an ear on the local repeater gang, monitor the cops, check out the weather or just plain listen around. These sensitive superhet receivers are just the ticket. They tune any 5 MHz portion of the band and have smooth varactor tuning, dual conversion with ceramic IF filters, AFC, adjustable squelch and plenty of speaker volume. Runs on 9V battery and performance that rivals the big rigs! For a complete finished pro look, add our matching case and knob set with screened graphics.
FM communications receiver kit $29.95
Specify band: FR 146 (2m), FR6 (6m), FR10 (10m), FR-220 (220 MHz)
Matching case & knob set, CFR $12.95

FM STEREO TRANSMITTER

Run your own stereo FM station! Transmit a stable signal in the standard FM broadcast band throughout the house, dorm or neighborhood. Connects easily to line outputs on CD player, tape decks, etc. Runs on 9V battery, has internal whip antenna and external antenna jack. Add our case set for a "station" look!
FM-10 kit $29.95
Matching case set, CFM $12.95

AIRCRAFT RCVR

Hear exciting aircraft communications—pick up planes up to 100 miles away! Receives 110–136 MHz AM air band, smooth varactor tuning superhet with AGC, ceramic filter, adjustable squelch, excellent sensitivity and lots of speaker volume. Runs on 9V battery. Great for air shows or just hanging around the airport! New 30-page manual details pilot talk, too. Add case set for "pro" look.
AR-1 kit $24.95
Matching case set, CAR $12.95

TERMS: Satisfaction guaranteed or 3 days on kits, 10 days on assembled units. If not pleased return in original form for refund. • Add $3.75 for shipping, handling and insurance. • For foreign orders add 20% for surface mail. • COD—U.S. only. Add $5.00. • Orders under $20 add $3.50. • NY residents add 7% sales tax. • 90-day parts warranty on kit parts. • 1-year parts & labor warranty on wired units.

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FAX 716-924-4555

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- Operating aides such as discounted tracking software and land line BBS.
- An extensive network of volunteers to provide you local technical assistance.
- The AMSAT Journal, your bi-monthly periodical devoted to the Amateur Space program.

It's Fun! It's Easy! It's Exciting!

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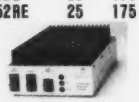
(301) 589-6062; Fax: (301) 608-3410

CIRCLE 110 ON READER SERVICE CARD

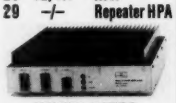
RF POWER AMPLIFIERS

NEW! 400 WATTS (144-148 MHz)

Model	Pin (W)	Pout (W)	Ic (A)	Gain/NF (dB)	(13.6 V) Type
50 MHz					
0508G	1	170	28	15/0.6	Standard
0508R	1	170	28	-/-	Repeater
0510G	10	170	25	15/0.6	Standard
0510R	10	170	25	-/-	Repeater
0550G	10	400	60	15/0.6	HPA
0550RH	10	400	60	-/-	Repeater HPA
0552G	25-40	400	55	15/0.6	HPA
0552RH	25-40	400	55	-/-	Repeater HPA
144 MHz					
1403G	1-5	10-50	6	15/0.6	LPA
1409G	2	150	25	15/0.6	Standard
1409R	2	150	24	-/-	Repeater
1410G	10	160	25	15/0.6	Standard
1410R	10	160	24	-/-	Repeater
1412G	25-45	160	20	15/0.6	Standard
1412R	25-45	160	19	-/-	Repeater
1450G	10	400	54	15/0.6	HPA
1450RH	10	400	54	-/-	Repeater HPA
1452G	25	400	50	15/0.6	HPA
1452RH	25	400	50	-/-	Repeater HPA
1454G	50-100	400	45	15/0.6	HPA
1454RH	50-100	400	45	-/-	Repeater HPA
220 MHz					
2210G	10	130	20	12/0.7	Standard
2210R	10	130	19	-/-	Repeater
2212G	30	130	16	12/0.7	Standard
2212R	30	130	15	-/-	Repeater
2250G	10	220	42	14/0.7	HPA
2250RH	10	280	45	-/-	Repeater HPA
2252G	25	220	36	14/0.7	HPA
2252RH	25	280	40	-/-	Repeater HPA
440 MHz					
4410G	10	100	19	10/1.1	Standard
4410R	10	100	18	-/-	Repeater
4412G	20-30	100	19	10/1.1	Standard
4412R	20-30	100	18	-/-	Repeater
4450G	10	175	34	12/1.1	HPA
4450RE	10	175	34	-/-	Repeater HPA
4452G	25	175	29	12/1.1	HPA
4452RE	25	175	29	-/-	Repeater HPA



MODEL 1410G



MODEL 1450G

All amplifiers (non-rptr) are linear, all-mode with fully automatic T/R switching and PTT capability. The receive preamps use GaAs FET devices rated at .5 dB NF with +18 dBm 3rd order IP. LPA, Standard and HPA amps are intermittent duty design suitable for base and mobile operation. Repeater amps are continuous duty, class C.

Amplifier capabilities: High-power, narrow or wide-band; 100-200 MHz, 225-400 MHz, 1-2 GHz. Military (28V), Commercial, etc. – consult factory. A complete line of Rx preamps also available.

RX Preamplifiers

Band	Model	NF (dB)	Gain (dB)	Connector
50 MHz	0520B	.5	25	BNC
50 MHz	0520N	.5	25	N
144 MHz	1420B	.5	24	BNC
144 MHz	1420N	.5	24	N
220 MHz	2220B	.5	22	BNC
220 MHz	2220N	.5	22	N
440 MHz	4420B	.5	18	GNC
440 MHz	4420N	.5	18	N

Consult your local dealer or send directly for further product information. All Products Made in USA.

TE SYSTEMS
TE SYSTEMS P.O. Box 25845 Los Angeles, CA 90025
TEL 213-478-0591 FAX 213-473-4038

CIRCLE 232 ON READER SERVICE CARD

73 Review

by Bill Clarke WA4BLC

The MFJ-247 Antenna Analyzer

SWR analyzer with a built-in frequency counter.

MFJ Enterprises, Inc.
P.O. Box 494
Mississippi State MS 39762
Telephone: (800) 647–1800
Price Class: $190

Last year I reviewed the MFJ-207 HF SWR analyzer from MFJ (see the January '91 issue, p. 18). It is an excellent device and it sure helped me set up my antenna system. This unit had a mechanical dial which gave me a good relative idea of the antenna's resonant point. However, to determine the exact resonant frequency, the user has to set up the unit by either beating a signal on a receiver or using an outboard frequency counter.

This was not a real problem for me, as I had a battery-operated counter and could plug it into the analyzer to get exact frequency readout. But suppose I didn't have a counter, or didn't want to carry two separate devices and their connection wires? Why not a combination unit that reads the SWR and frequency simultaneously? Well, that is exactly what MFJ has done with their model MFJ-247 HF SWR Analyzer.

What is an SWR Analyzer?

The MFJ-247 is used to accurately find the SWR of an antenna at the shack feedline, the antenna, the tuner, or any point between. No RF signal is required from your transmitter.

The new analyzer is completely portable for field use, meaning no trips back to the shack to check SWR on your antenna. It provides a means for eliminating on-the-air tune-ups for setting up antennas, or when adjusting a tuner. Trimming and adjusting can be done at the same time measurements are made.

Using the MFJ-247 in the Field

Although the analyzer is very simple to operate, a quick read of the instruction manual is advisable. It won't take more than five minutes, as the instructions are clear and simple.

Using the analyzer for setting up a new 160 meter dipole, I initially figured the leg lengths of the dipole to be 126.5 feet each. I cut the legs a couple of feet over-size (a recommended practice). After assembly, the antenna was hauled into place. Connecting the analyzer to the feedline at the base of the tower, I selected the 1.8–2.9 MHz band (the other bands are 3.2–5.3, 6.5–11, 12–21, 18–30 with overrun on each). The tuning knob was slowly turned until the meter showed the lowest SWR point.

When the lowest point was located, I read the frequency from the LCD indicator, which showed 1.795 MHz. I brought the antenna down and trimmed some wire off each leg,

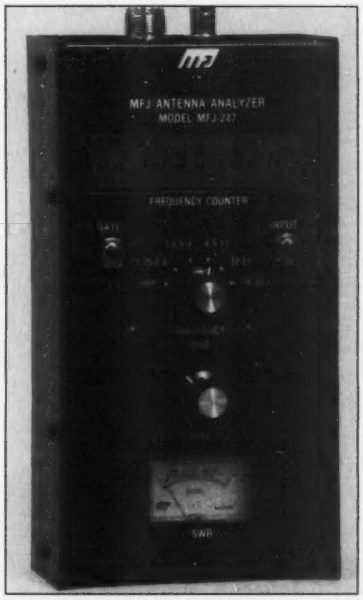


Photo A. The MFJ-247 digital SWR analyzer.

raised it again, and rechecked the lowest SWR point. The readout was 1.846 MHz. Close enough!

The dipole was put in place and tuned without returning to the shack. There were no on-the-air tune-ups. I merely connected the antenna's feedline to my remote antenna switch and was finished with my outside work.

Checking Feedlines in the Shack

I hooked the analyzer onto the feedline in my shack to assure that all was going to work as planned. A patch line was run from my transceiver selection switch to the SO-239 on top of the analyzer. I checked each antenna for exact the frequency of the lowest SWR, and made a notation in my station log.

If you are unsure of an antenna's SWR at a specific frequency, just tune the analyzer until it displays that frequency and read the SWR from the meter.

It is particularly interesting to make SWR plots of multiband antennas. Generally you will discover there are multiple points of low SWR, often where you may not expect them. Graph paper will help you make permanent records of the SWR plots of your antennas.

Adjusting a Tuner With the 247

You can use the SWR Analyzer as an aid in adjusting an antenna tuner without putting out a carrier on the air. By using a good quality self-grounding coax switch, you can select between the transmitter and the analyzer on the input side of an antenna tuner. Once selected, tune the analyzer to the frequency you will be transmitting on and adjust the tuner for the lowest SWR reading on the analyzer's SWR meter.

Just switch the feedline back to the transmitter and you are ready to operate. A word of warning: DO NOT TRANSMIT INTO THE ANALYZER or you will fry it!

Frequency Counter

The analyzer also functions as a frequency counter with up to six decimal places of display (i.e. 146.310025 MHz). This gives the MFJ-247 a dual purpose: an SWR analyzer and a frequency counter in one box.

I should note that the counter is not very sensitive, and, as is mentioned in the manual, the use of a "times 1" probe is recommended. For service work inside a transceiver this would be necessary, but for general frequency checking a rubber-duck on the top BNC connector is sufficient.

The manual has some good information about coax feedline losses and explains why high SWR can increase these losses. Also included is a sample SWR antenna plot chart, which can be copied.

My Recommendation

I enjoyed working on my antenna system with the original antenna analyzer and using the MFJ-247 just makes it easier since everything is inside one box.

Anyone working with antennas will find a use for the analyzer. It will be a real help for tuning a beam on top of a tower and setting the bands on a vertical. Also, the idea of "a no-carrier tune-up" is excellent.

Specifications

Dimensions: 4 x 7.5 x 2.5 inches (WHD)
Frequency: 1.75–33.5 MHz
Power: 12 VDC @ 300 mA
Batteries: 6 AA
Counter Sensitivity: 600 mV

Battery Watchdog

Keeps your battery up to snuff.

by Martin E. McCoy WBØTCZ/7

My station runs primarily from a 12 volt deep cycle battery under the shack, providing emergency power capability at a moment's notice. However, my 2 meter all-mode with a 170 watt linear drains the battery rapidly during my sessions as Net Control, and my other station equipment just adds insult to injury. With more 12 volt equipment planned, and my habit of forgetting to turn the charger on and off as needed to keep my battery fully (but not over) charged, I needed something to monitor my battery status and keep it charged.

With this in mind, I decided my battery watchdog should turn a charger on when the battery voltage drops below 11 volts, and turn it off when the battery voltage rises to 14 volts.

The parts for the watchdog are easy to find at Radio Shack, a discount store and a quick stop at a TV/stereo repair shop (or parts house). (See the Parts List.) If you refer to the schematic (Figure 1), my explanation of this circuit will make more sense.

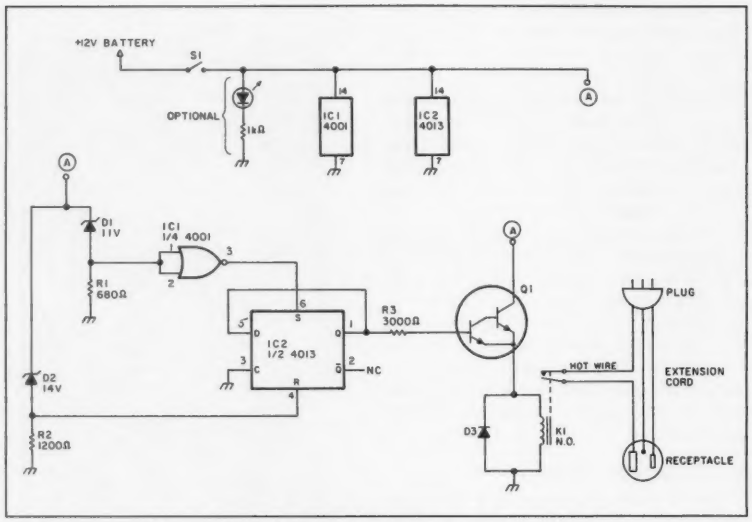


Figure 1. The schematic diagram of the battery watchdog.

Charger On

Zener diode D1 conducts as long as the battery voltage is over 11 volts. To maintain a stable voltage, this diode must conduct at least 11 mA, and since I don't want to draw more power than necessary, the series resistor of 680 ohms will keep the current down to a reasonable 16 mA. Since I wanted a high (logic 1) signal when the battery voltage drops below 11 volts, I used the 11 volt output from the zener regulator to drive one of the four gates in the 4001 CMOS quad's two-input NOR gate. By tying the two inputs to this NOR gate together, it functions as an inverter. Since it is a CMOS gate, it will operate directly from the 12 volt battery, and an 11 volt input won't harm it.

Charger Off

Zener diode D2 conducts when the battery voltage exceeds 14 volts. To maintain a stable voltage, D2 must conduct at least 8.9 mA, and since I don't want to draw more power than necessary, the series resistor of 1200 ohms will keep the current down to a reasonable 12 mA. Since this zener regulator provides the high (logic 1) output I want when the battery voltage exceeds 14 volts, no inverter is necessary.

Charger Control

One of the flip-flops in the 4013 CMOS dual D type flip-flop is used to turn the charger on and off. If the Q output is connected to the D (Data) input and the clock input is grounded, then it behaves as an R-S flip-flop. In other words, when a high (logic 1) is applied to the S (Set) terminal, Q goes high and remains there until a high is applied to the R (Reset) terminal, causing Q to go low (logic 0).

Operation

Assume that the flip-flop is off—that is, its Q output is low. With Q low, no current is supplied to the NPN Darlington Q1, it doesn't conduct and relay K1 is open, leaving the battery charger off.

When the battery becomes discharged, the voltage available drops below 11 volts. The regulator circuit containing D1 ceases to conduct, removing the input from IC1. Since IC1 is a NOR gate operating as an inverter, a lack of input causes the output to go high. Since this output is connected to the S (Set) input of IC2 (the flip-flop), the output Q goes high. This high output passes through R3 to keep the base current through Q1 to a reasonable value. Since Q1 is a Darlington transistor with a gain of at least 2500, this small current through the base is more than sufficient to allow the transistor to pass the 38 mA required to pull relay K1 in. When this relay is energized, the battery charger begins charging the battery.

When the battery charger starts charging the battery, the voltage available rises above 11 volts. This causes the regulator circuit containing D1 to begin conducting, supplying a high to the input of IC1. As you remember, IC1 acts as an inverter, so its output goes low, removing the high to the S (Set) input of IC2. But the output Q of the flip-flop remains high because the R (Reset) terminal is not receiving a high from the regulator circuit containing D2.

When the battery is fully charged, the battery voltage exceeds 14 volts. The regulator circuit containing D2 conducts, supplying a high to the R (Reset) input of IC2. When this happens, the flip-flop resets, output Q goes low and transistor Q1 stops conducting, releasing relay K1. The battery charger stops charging.

The diode across the coil of relay K1 clamps the voltage spike that occurs when

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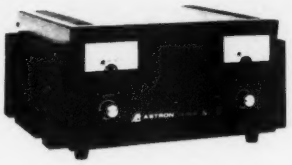

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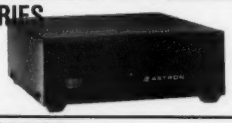
- RIPPLE Less than 5mv peak to peak (full load & low line)
- All units available in 220 VAC input voltage (except for SL-11A)

SL SERIES

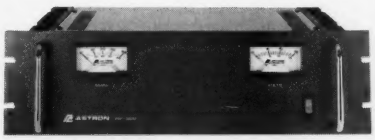


MODEL	Colors Gray	Colors Black	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
• LOW PROFILE POWER SUPPLY						
SL-11A	•	•	7	11	2¾ x 7⅛ x 9¾	11

RS-L SERIES

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
• POWER SUPPLIES WITH BUILT IN CIGARETTE LIGHTER RECEPTACLE				
RS-4L	3	4	3½ x 6⅛ x 7¼	6
RS-5L	4	5	3½ x 6⅛ x 7¼	7

RM SERIES



MODEL RM-35M

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
• 19" RACK MOUNT POWER SUPPLIES				
RM-12A	9	12	5¼ × 19 × 8¼	16
RM-35A	25	35	5¼ × 19 × 12½	38
RM-50A	37	50	5¼ × 19 × 12½	50
RM-60A	50	55	7 × 19 × 12½	60
• Separate Volt and Amp Meters				
RM-12M	9	12	5¼ × 19 × 8¼	16
RM-35M	25	35	5¼ × 19 × 12½	38
RM-50M	37	50	5¼ × 19 × 12½	50
RM-60M	50	55	7 × 19 × 12½	60

RS-A SERIES

MODEL RS-7A

MODEL	Colors Gray	Colors Black	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-3A		•	2.5	3	3 × 4¾ × 5¾	4
RS-4A	•	•	3	4	3¾ × 6½ × 9	5
RS-5A		•	4	5	3½ × 6⅛ × 7¼	7
RS-7A	•	•	5	7	3¾ × 6½ × 9	9
RS-7B	•	•	5	7	4 × 7½ × 10¾	10
RS-10A	•	•	7.5	10	4 × 7½ × 10¾	11
RS-12A	•	•	9	12	4½ × 8 × 9	13
RS-12B		•	9	12	4 × 7½ × 10¾	13
RS-20A	•	•	16	20	5 × 9 × 10½	18
RS-35A	•	•	25	35	5 × 11 × 11	27
RS-50A	•		37	50	6 × 13¾ × 11	46

RS-M SERIES

MODEL RS-35M

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
• Switchable volt and Amp meter				
RS-12M	9	12	4½ × 8 × 9	13
• Separate volt and Amp meters				
RS-20M	16	20	5 × 9 × 10½	18
RS-35M	25	35	5 × 11 × 11	27
RS-50M	37	50	6 × 13¾ × 11	46

VS-M AND VRM-M SERIES

MODEL VS-35M

• Separate Volt and Amp Meters • Output Voltage adjustable from 2-15 volts • Current limit adjustable from 1.5 amps to Full Load

MODEL	Continuous Duty (Amps) @13.8VDC	@10VDC	@5VDC	ICS* (Amps) @13.8V	Size (IN) H × W × D	Shipping Wt. (lbs.)
VS-12M	9	5	2	12	4½ × 8 × 9	13
VS-20M	16	9	4	20	5 × 9 × 10½	20
VS-35M	25	15	7	35	5 × 11 × 11	29
VS-50M	37	22	10	50	6 × 13¾ × 11	46
• Variable rack mount power supplies						
VRM-35M	25	15	7	35	5¼ × 19 × 12½	38
VRM-50M	37	22	10	50	5¼ × 19 × 12½	50

RS-S SERIES

MODEL RS-12S

• Built in speaker

MODEL	Colors Gray	Colors Black	Continuous Duty (Amps)	ICS* Amps	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-7S	•	•	5	7	4 × 7½ × 10¾	10
RS-10S	•	•	7.5	10	4 × 7½ × 10¾	12
RS-12S	•	•	9	12	4½ × 8 × 9	13
RS-20S	•	•	16	20	5 × 9 × 10½	18

*ICS—Intermittent Communication Service (50% Duty Cycle 5min. on 5 min. off)

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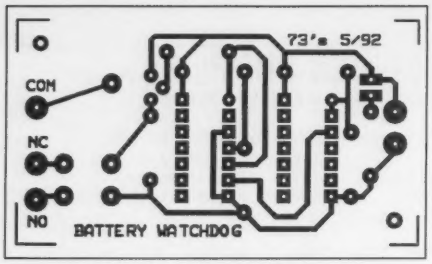

Figure 2. PC board foil pattern.

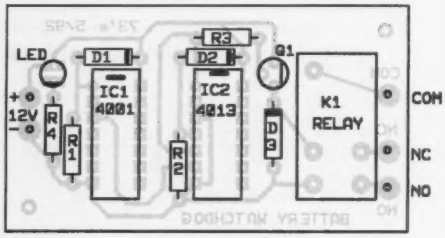

Figure 3. Parts placement.

Parts List

QTY	Part Number	Description
1	RCA SK11A/5020A	11 volt 0.5 watt zener diode
1	RCA SK14A/5023A	14 volt 0.5 watt zener diode
1	RS 276-2401	4001 CMOS quad two-input NOR gate
1	RS 276-2413	4013 dual-type D flip-flop
1	RS 276-2068	NPN Darlington transistor
1	RS 271-021	680 ohm 0.5 watt resistor
1	RS 271-024	1200 ohm 0.5 watt resistor
1	RS 271-028	3000 ohm 0.5 watt resistor
1	RS 276-1102	1N4003 rectifier
1	RS 275-624	SPST switch
1	RS 275-248	5A 125V relay 12 VDC coil
1	RS 270-233	Project box
1	N/A	3-wire extension cord

A blank PC board is available for $3 + $1.50 shipping from FAR Circuits, 18N640 Field Court, Dundee IL 60118.

the transistor turns off. Without this diode the transistor has a short life!

Construction

I found that a perfboard and point-to-point wiring was a good way to construct this circuit. *[Ed. note: An etched and drilled PC board is also available.]* A hacksaw and a file trimmed my perfboard scrap to fit inside the metal box easily. I drilled holes in the box and the perfboard for mounting standoffs before beginning construction.

Try to arrange the components on the perfboard neatly. I find I make fewer mistakes this way, and it looks better, too. I passed the 12 volt power cord and the extension cord (both in and out) of the box using plastic crimp-style strain reliefs.

Tie all the inputs of all unused gates in both IC1 and IC2 to ground. For IC1 (the 4001 CMOS NOR gate), this would be the six unused inputs. For IC2 (the 4013 CMOS flip-flop) this would be the D, S, C and R inputs. If these inputs are left floating (not connected to ground), the two CMOS integrated circuits are very vulnerable to damage from static.

Mount the relay away from the other components on the board. Cut the extension cord in the middle, and pass the two ends through holes in the box. Connect the neutral and ground wires back together with either wire nuts or a careful solder job and insulating tape. This is 120 VAC at significant amperage you have available and it will do damage if you make a mistake, **so be careful!** Solder the hot wire to the Normally Open terminals of the relay. The same precaution applies here, so be careful! Secure the wires to the circuit board near where they are soldered to the relay so accidental movement doesn't twist them loose.

When wiring the switch in the circuit, you can add an LED and a series resistor (1000 ohms) if you want a power indicator.

When you place the perfboard in the box, examine the area between the bottom of the circuit board and the box for any possible shorts. I neglected to do this and was rewarded by an impressive display of sparks!

If you have problems with RFI from your transmitters, ground the metal case. Add a toroid coil in series with both the positive and negative DC power leads. Bypass this coil to ground with a ceramic capacitor (0.01 µF). An electrolytic across the DC input will also help. Additional bypassing may be needed on the extension cord. Ceramic capacitors (0.01 µF) will help here, too.

My battery watchdog has worked quite well, and I don't worry about a dead battery or scrambling to plug the battery charger in during a session as net control.

I want you to be aware that a charging lead-acid battery produces a sufficient amount of hydrogen to cause a very damaging explosion. My battery is not in the shack, but under my home, vented to the outside. Two AWG 00 cables bring DC into my shack with very little voltage drop (0.5 volt measured at 40 amps).

Now when the power goes off in the middle of the sweepstakes or during a rare DX contact, you can just smile and keep hamming! 73

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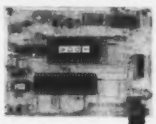

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MODEL	BANDS	LENGTH	PRICE
G5RV-MB	80-10 (model illustrated)	102'	$49.95 PPD
G5RV	80-10 (no xfmr or cable, with 31' bal. feedline)	102'	$34.95 PPD
G5RV JR	40-10 (no xfmr or cable, with 26' bal. feedline)	51'	$29.95 PPD

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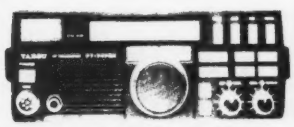

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Hardware and software interfaces for Kenwood rigs.

by F. Barry McWilliams WK2S

Computers are finding their place in ham radio shacks in ever-increasing frequency. They are being used to replace paper logs for both general operation and, especially, for contest operation. They are being used as word processors to produce club newsletters. They are being used for learning CW, and there are programs available that tutor you in the theory and regulations for different grades of ham licenses. They are being used for all sorts of complex calculations, such as Minimum Usable Frequency (MUF), great circle beam headings and distance, Smith charts, antenna patterns and circuit analysis. The next step is the use of the computer for actually controlling your station.

Though often unseen by their users, computer control is commonplace in many VHF repeater installations. A microcomputer, not unlike the one in your desktop computer, controls the repeater's transmit, receive and identification functions. However, unlike the desktop computer, the repeater control computer runs only one program, the program that controls the repeater.

This article examines the hardware and software interfaces that make it possible to control your HF station with your IBM-compatible desktop computer. The major ham radio manufacturers each offer computer control for some of their HF and VHF transceivers. Here we'll look at the hardware and software interface provided by Kenwood for computer control of the following models:

- TS-140S
- TS-440S
- TS-940S
- TS-950S
- TS-711S
- TS-811S
- R5000

First, we will examine the hardware interface between the computer and the radio. Then we will discuss how a computer program can control the operation of the radio by taking a look at some sample segments of BASIC code.

Hardware Interface

The hardware interface between the radio and your computer is a straightforward RS-232C serial interface, not unlike your computer's interface to a telephone modem or a packet TNC. The Kenwood transceivers require an interface kit that is installed in the transceiver, and a level converter unit, IF-232C, that comes as a separate unit with cables that connect to your computer and to your radio. Figure 1 shows the hardware configuration for the TS-940S.

Photo A. Easy computer control of your rig is possible with this simple interface.

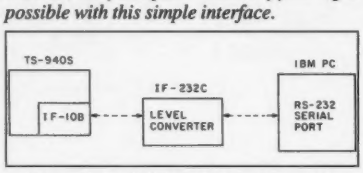

Figure 1. TS-940S-to-PC configuration.

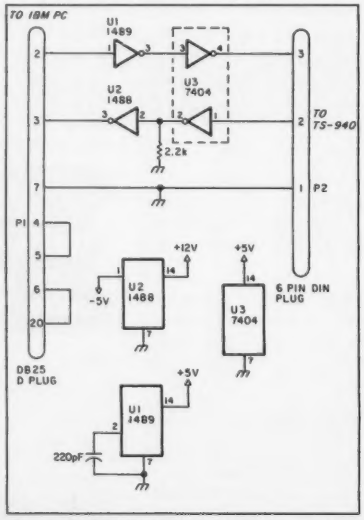

Figure 2. TTL/RS-232 level converter. Integrated circuits: U1 MC1489 RS232 quad line receiver (Radio Shack 276-2521); U2 MC1488 RS232 quad line driver (Radio Shack 276-2520); U3 7404 hex inverter (Radio Shack 276-1802). Miscellaneous: P1 - 25-pin female type D plug (Radio Shack 276-1548); P2 - 6-pin DIN plug (Radio Shack 274-020).

The IF-10B computer interface kit is installed in the TS-940S, and the output of the computer interface is available at the ACC1 accessory connector on the rear panel of the TS-940S. The signals at the ACC1 connector are TTL logic levels, 0 and +5 volts. The IF-232C level converter converts the TTL signals to RS-232 standard levels required for use with the serial IO ports on IBM and compatible PCs.

There are different interface kits for various models of the Kenwood radios. You should check with a Kenwood dealer to be sure you have the interface kit that matches your particular radio. The IF-232C level converter is the same for all of the Kenwood radios. You can build your own IF-232C and save a bit of money over the Kenwood accessory.

A home-brew converter is shown in Figure 2. It consists of only three integrated circuits: a TTL inverter (7404), a TTL-to-RS-232 level converter (1488) and a RS-232-to-TTL converter (1489). I built this circuit on a Radio Shack perf board using sockets for the ICs and small gauge (wire wrap) wire for connections.

The power supply requirements are minimal:

- +5 volts is required for the 7404 TTL logic IC and the converter chips.
- +9 to +12 volts can be used for the positive RS-232 level.
- −5 to −12 volts can be used for the negative RS-232 level.

The positive and negative RS-232 levels do not need to match one another. I used a Coleco game power pack that supplied +5, +12 and −5 volts.

Software Interface

The PC communicates with the radio by means of commands sent to the radio as a string of characters. For example, if the com-

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puter sends the following string to the radio: FA00014300000; then the frequency of VFO A is set to 14.300 MHz. Some commands elicit a response from the radio to the PC. For example: IF; requests the radio to send a report of its current settings to the PC. The radio responds with a string of data that includes the current frequency, RIT and XIT frequency, the operating mode (USB, LSB,CW), and so forth.

Because the BASIC programming language is practically the lingua franca of personal computer languages, I will use some simple fragments of BASIC code to illustrate how you can control your radio from your computer. At the end of this article, we will put all the fragments together to form a rudimentary program that allows you to send control commands to your radio and receive status returned from the radio.

	Interface Kit	Level Converter
TS-940S	IF-10B	IF-232C
TS-950S	built-in	built-in
TS-440S, TS-680S, R-5000	IC-10	IF-232C
TS-140S	IF-10C	IF-232C
TS-711A, TS-811A	IF-10A	IF-232C
TS-711A	IF-10A	IF-232C
TS-790A	(none) built-in	IF-232C

Table 1. Interface kit and level converter matches for Kenwood radios.

PC-Radio Communications

The first order of business is to get the PC and the radio talking to one another. The radio interface always communicates at a particular speed and data format; the Kenwood interface is set to 4800 baud and 8 data bits. The BASIC OPEN statement initializes the PC for serial communication as shown below:

```
510 OPEN "COM2:4800,N,8" AS #1 ' OPEN COM
  port 2
520 COM(2) ON
```

These statements initialize PC communications port 2. To initialize port 1, change the number, 2, in each of the above statements to 1.

Handling Asynchronous Input From the Radio

The Kenwood radios communicate with the PC by sending a series of characters to the PC. A complete string of characters is ended with a semi-colon (;). The PC program must be able to process each character as it arrives from the radio and store the characters until a semi-colon comes along.

The BASIC ON statement enables us to write code that is executed each time a character comes along. The ON statement illustrated below routes control to a subroutine at statement 5000. The subroutine:

- saves the character from the radio,
- looks for a semi-colon meaning the end of input,
- sets the variable L to 1 when a semi-colon is found.

```
100 ON COM(2) GOSUB 5000 ' setup for COM port 2
  interrupts
```

Command	
ID;	Returns id of radio. ID003; for TS940 ID004; for TS440 ID005; for R5000
FAggmmmkkkhhh;	Set VFO A frequency. Where gg = gigahertz, mmm = megahertz, kkk = kilohertz ahd hhh = hertz. All the values must be specified, so to set the VFO A to 7.335 MHz, enter FA00007335000;
FBggmmmkkkhhh;	Set VFO B frequency.
FA;	Read VFO A's frequency. You should see a response from the radio that looks much like the Set VFO A frequency command. The response will be of the form, FAggmmmkkkhhh, and can be interpreted in the same manner as the SET VFO frequency command.
FB;	Read VFO B's frequency.
IF;	Read radio information. The response from the radio is 35 bytes long and of the form, IFggmmmkkkhhhheeeeeSKHHHrxbNNtMfcp----; ggmmmkkkhhh .. display frequency, gg,mmm.kkkhhh MHz eeeee ..... step frequency, ee,eee Hz S ..... plus(+) or minus(-) RIT/XIT direction KHHH ..... RIT/XIT frequency, k.hhh KHz r ..... 0 if RIT is off, 1 if RIT is on x ..... 0 if XIT is off, 1 if XIT is on b ..... memory bank number (TS-940) NN ..... memory number t ..... 0 if transmitter on, 1 if transmitter off M ..... 1 if LSB, 2 if USB 3 if CW, 4 if FM 5 if AM, 6 if FSK f ..... 0 if VFO A 1 if VFO B 2 if memory c ..... 0 if scan off, 1 if scan on p ..... 0 if split off, 1 if split on ---- ..... blanks (not used)
AI1;	Turn auto-information on. Whenever any radio function is changed, the IF information (see above) is sent to the computer.
AI0;	Turn auto-information off.
FN0; FN1; FN2;	Select VFO A Select VFO B Select memory (VFO/Mem)
MCbmm;	Select memory bank b, channel mm
DN; UP;	Step VFO frequency or memory channel down one step. Step VFO frequency or memory channel up one step.
LK0; LK1;	Frequency Lock off Frequency Lock on
MD1; MD2; MD3; MD4; MD5; MD6;	Select LSB Select USB Select CW Select FM Select AM Select FSK
RT0; RT1; XT0; XT1; RD; RU; RC;	RIT off RIT on XIT off XIT on Tune RIT/XIT down 10 Hz Tune RIT/XIT up 10 Hz Clear RIT/XIT
RX; TX;	Receive (transmit off) Transmit
SC0; SC1; MS0; MS1; HD0; HD1;	Program scan off Program scan on Memory scan off Memory scan on Scan hold off Scan hold on
SP0; SP1;	Split off Split on
AT;	Antenna tuner
LO; SH; SHvv; SLvv; SLvv; VB; VBvv;	enable remote control of slope tune and VBT (TS-940) read Slope tune high set Slope tune high. vv is a value between 00 and 31 read Slope tune low set Slope tune low. vv is a value between 00 and 31 read VBT set VBT. vv is a value between 00 and 31
MR bNN;	Read memory. b is memory bank NN is memory channel This command returns the data in the selected memory in the form, MR bNNggmmmkkkhhhhM-----; M is the mode (LSB, USB, etc.) with the same values as M in the IF response, above.
MW bNNggmmmkkkhhhhM-----;	Write memory b is memory bank NN is memory channel ggmmmkkkhhh is the frequency M is the mode (LSB, USB, etc.) with the same values as M in the IF response, above.
VR; DI; DS1; DS0; OS; ST;	Voice recall DCL ID readout of call sign DCL on DCL off Offset Tone number step

Table 2. Radio commands. The commands you can issue and the response you should expect back from the radio.

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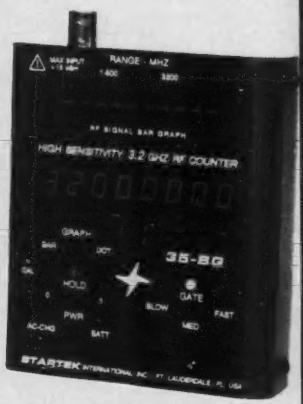

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```
5000 REM - process characters from COM Port
5060 IF EOF(1) THEN RETURN
5070 C$=C$+INPUT$(LOC(1),#1)
5080 IF INSTR(C$,";")=0 THEN GOTO 5060 ' semi-colon means end-of-data
5090 L=1:CI$=C$:C$="" ' Set L=1 and put the data in CI$
5110 RETURN ' for later use.
```

Sending Commands to the Radio

Control commands are sent to the radio by means of the BASIC PRINT statement. The following subroutine asks the user to enter a radio command and then, at line 8060, sends the command to the radio. Line 8060 takes the user input in the variable A$ and does a PRINT #1 to send the command to the serial communications port. The semi-colon (;) in line 8060 is needed to tell BASIC that a carriage return character should not be sent to the radio at the end of the PRINT string.

```
8000 REM - Enter a radio command
8010 PRINT "Enter command ===> "; ' prompt user for command
8040 LINE INPUT A$ ' input command from user
8050 IF A$="" THEN RETURN
8060 PRINT #1,A$; ' send command to radio
8910 RETURN
```

We need a way to get to this code so the user can enter a command. This can be done by setting up a function key so that this routine is called whenever the function key is pressed.

```
650 ON KEY(3) GOSUB 8000 ' setup F3 key
652 KEY 3,"Cmd "
660 KEY(3) ON
```

Main Program

The main program will spend all of its time simply waiting for input from the radio or the user.

```
1000 REM - Main Program loop
1020 IF INKEY$=CHR$(27) THEN STOP ' Esc key pressed ... STOP
1100 IF L=1 THEN GOSUB 6000:L=0: GOTO 1020
 ' Data from radio ... display
1190 GOTO 1020
```

Line 1020 uses the BASIC INKEY function and tests to see if the user has pressed the Escape key. If so, the program will stop.

Line 1100 tests the variable L which is set in the radio input subroutine when a semicolon is found (see line 5090, above). L=1 means that a complete line has been received from the radio. The main program calls the routine at line 6000 to display the data received from the radio.

Line 1190 routes control back to be top of the main program loop.

Display of Data from the Radio

For our simple program, the subroutine to display data received from the radio will just print the data saved in CI$.

```
6000 REM - display data from Radio
6010 PRINT CI$ ' Display CI$ to see what we got.

6350 RETURN
```

Or, you can use the following code that illustrates how you might extract the data returned from the IF; command.

```
6000 REM - display data from Radio
6010 PRINT CI$ ' Display CI$ to see what we got.
6020 IF MID$(CI$,1,2)>"IF" THEN RETURN ' is this an IF response?
6030 RIT=VAL(MID$(CI$,24,1)) ' sort out data in response
6040 XIT=VAL(MID$(CI$,25,1))
6050 MC=VAL(MID$(CI$,27,2))
6060 XMIT=VAL(MID$(CI$,29,1))
6070 MODE=VAL(MID$(CI$,30,1))
6080 FUNC=VAL(MID$(CI$,31,1))
6090 SCAN=VAL(MID$(CI$,32,1))
6100 SPLIT=VAL(MID$(CI$,33,1))
6110 MHZ=VAL(MID$(CI$,6,2))
6111 KHZ=VAL(MID$(CI$,8,3))
6112 HZ=VAL(MID$(CI$,11,3))
6120 PRINT " Freq: ";
6132 PRINT MID$(CI$,6,2);".";  ' MHz
6133 PRINT MID$(CI$,8,3);",";  ' kHz
6134 PRINT MID$(CI$,11,3);     ' Hz
6140 IF RIT THEN COLOR 7,4:PRINT " RIT ";:COLOR 7,0 ELSE PRINT "     ";
6150 IF XIT THEN COLOR 7,4:PRINT " XIT ";:COLOR 7,0 ELSE PRINT "     ";
6160 IF (RIT+XIT)=0 THEN COLOR 7,0 ELSE COLOR 0,7  ' reverse if XIT or RIT
6170 PRINT MID$(CI$,19,1);" ";MID$(CI$,20,1);".";MID$(CI$,21,2);
6180 COLOR 7,0
6200 PRINT " Mode: ";
6210 IF MODE=1 THEN PRINT "LSB";
6220 IF MODE=2 THEN PRINT "USB";
6230 IF MODE=3 THEN PRINT "CW ";
6240 IF MODE=4 THEN PRINT "FM ";
6250 IF MODE=5 THEN PRINT "AM ";
6260 IF MODE=6 THEN PRINT "FSK";
6300 PRINT " Function: ";
6310 IF FUNC=0 THEN PRINT "VFO A     ";
6320 IF FUNC=1 THEN PRINT "VFO B     ";
6330 IF FUNC=2 THEN PRINT "Memory ";:PRINT MC;
6340 PRINT
6350 RETURN
```

Complete program

```
100 ON COM(2) GOSUB 5000        ' setup for COM port 2 interrupts
510 OPEN "COM2:4800,N,8" AS #1 ' OPEN COM port 2
520 COM(2) ON
650 ON KEY(3) GOSUB  8000                ' setup F3 key
652 KEY 3,"Cmd   "
660 KEY(3) ON
1000 REM - Main Program loop ----------------------------------------
1020 IF INKEY$=CHR$(27) THEN STOP        ' Esc key pressed ... STOP
1100 IF L=1 THEN GOSUB 6000:L=0:GOTO 1020 ' Data from radio ... display
1190 GOTO 1020
5000 REM - process characters from COMM Port -------------------------
5060 IF EOF(1) THEN RETURN
5070 C$=C$+INPUT$(LOC(1),#1)
5080 IF INSTR(C$,";")=0 THEN GOTO 5060 ' semi-colon means end-of-data
5090 L=1:CI$=C$:C$=""                   ' Set L=1 and put the data in CI$
5110 RETURN                              ' for later use.
6000 REM - display data from Radio ----------------------------------
6010 PRINT CI$                           ' Display CI$ to see what we got.
6020 IF MID$(CI$,1,2)<>"IF" THEN RETURN ' is this an IF response?
6030 RIT=VAL(MID$(CI$,24,1))             ' sort out data in response
6040 XIT=VAL(MID$(CI$,25,1))
6050 MC=VAL(MID$(CI$,27,2))
6060 XMIT=VAL(MID$(CI$,29,1))
6070 MODE=VAL(MID$(CI$,30,1))
6080 FUNC=VAL(MID$(CI$,31,1))
6090 SCAN=VAL(MID$(CI$,32,1))
6100 SPLIT=VAL(MID$(CI$,33,1))
6110 MHZ=VAL(MID$(CI$,6,2))
6111 KHZ=VAL(MID$(CI$,8,3))
6112 HZ=VAL(MID$(CI$,11,3))
6120 PRINT "  Freq: ";
6132 PRINT MID$(CI$,6,2);".";  ' MHz
6133 PRINT MID$(CI$,8,3);",";  ' kHz
6134 PRINT MID$(CI$,11,3);     ' Hz
6140 IF RIT THEN COLOR 7,4:PRINT " RIT ";:COLOR 7,0 ELSE PRINT "     ";
6150 IF XIT THEN COLOR 7,4:PRINT " XIT ";:COLOR 7,0 ELSE PRINT "     ";
6160 IF (RIT+XIT)=0 THEN COLOR 7,0 ELSE COLOR 0,7  ' reverse if XIT or RIT
6170 PRINT MID$(CI$,19,1);" ";MID$(CI$,20,1);".";MID$(CI$,21,2);
6180 COLOR 7,0
6200 PRINT " Mode: ";
6210 IF MODE=1 THEN PRINT "LSB";
6220 IF MODE=2 THEN PRINT "USB";
6230 IF MODE=3 THEN PRINT "CW ";
6240 IF MODE=4 THEN PRINT "FM ";
6250 IF MODE=5 THEN PRINT "AM ";
6260 IF MODE=6 THEN PRINT "FSK";
6300 PRINT " Function: ";
6310 IF FUNC=0 THEN PRINT "VFO A     ";
6320 IF FUNC=1 THEN PRINT "VFO B     ";
6330 IF FUNC=2 THEN PRINT "Memory ";:PRINT MC;
6340 PRINT
6350 RETURN
8000 REM - Enter a radio command ------------------------------------
8010 PRINT "Enter command ===> ";        ' prompt user for command
8040 LINE INPUT A$                       ' input command from user
8050 IF A$="" THEN RETURN
8060 PRINT #1,A$;                        ' send command to radio
8910 RETURN
```

The complete interface and control program.

AVAILABLE NOW!
FANTASTIC 2-METER H.T.'s
HIGH PERFORMANCE AT A GREAT PRICE

- DJ-F1TH World's smallest 5 watt H.T.
- DJ-162TR Full featured 2-meter comes standard with EDC-34 rapid charger

New Model DJ-580T

RATED # 1 IN JAPAN, NOW AVAILABLE IN THE U.S.

A super-compact handheld, the tiny DJ-580T is a powerful, feature-packed twin bander. This super-compact HT is the smallest you'll find, and literally fits in the palm of your hand.

Ergonomic design, combined with excellent sensitivity and unbelievable great sound, sets a new standard for miniature HT's.

New MCF function allows you to set the 40 memory channels regardless of which channels you want for VHF or UHF. Any combination is possible.

Alinco's DJ-580T has Full-Duplex Cross Band Operation and Cross Band Repeater Functions with real world power and excellent sensitivity. Airband receive with simple modification.

If the battery is depleted to less than 5 volts, Alinco's Patented Super Low Battery Consumption Function is automatically activated. You can continue to operate the radio all the way down to 3.5 volts. This feature is effective with dry cell batteries only.

This unit has built in DSQ for paging, CTCSS encode and decode standard, various scanning functions, 3 power level selections for each band, bell function, and an illuminated keypad.

Check out the affordable technology of the 90's.
Check out ALINCO.

ALINCO ELECTRONICS INC.

ALINCO ELECTRONICS INC.
438 Amapola Avenue, Unit 130, Torrance, CA 90501
Tel. (310) 618-8616 Fax (310) 618-8758

Two Year Limited Warranty.
Specifications and features are subject to change without notice or obligation.

CIRCLE 67 ON READER SERVICE CARD

```
6200 PRINT " Mode: ";
6210 IF MODE=1 THEN PRINT "LSB";
6220 IF MODE=2 THEN PRINT "USB";
6230 IF MODE=3 THEN PRINT "CW ";
6240 IF MODE=4 THEN PRINT "FM ";
6250 IF MODE=5 THEN PRINT "AM ";
6260 IF MODE=6 THEN PRINT "FSK";
6300 PRINT " Function: ";
6310 IF FUNC=0 THEN PRINT "VFO A ";
6320 IF FUNC=1 THEN PRINT "VFO B ";
6330 IF FUNC=2 THEN PRINT "Memory ";:PRINT
   MC;
6340 PRINT
6350 RETURN
```

Running the Program

If the above program lines are combined, you have a complete BASIC program that can control your Kenwood radio. You will need to choose the proper communications port number (1 or 2) in lines 100, 510 and 520. When you run the program, press the F3 key and you will be prompted to enter a radio command. First try the ID; command. You should see a line displayed on your computer display which is the response from the radio. The ID command response should look like "ID00n;", where n is a number that corresponds to the model of your radio (for example, ID003 is returned by a TS-940.) Next, try the AI1; command. This command will cause the radio to report its status whenever a change is made. After entering the AI1; command, turn the radio tuning dial, and you should see the response displayed on your computer screen.

A description of the radio commands appears at the end of this article.

RFI

Computers in the ham shack have been notorious for causing interference to the ham receiver. I have had the opportunity to use an original model IBM PC, an IBM PCjr and an IBM PC Convertible (laptop) in my shack. Each of these PCs has caused some interference, but I've found that the interference is reduced to an acceptable level by:

- use of shielded cables for antenna connections, and
- separation of the radio antenna from the computer.

In other words, the proximity of the antenna to the computer is more significant than the pickup of interference from computer interconnections to its keyboard, display or other outboard computer accessories.

I could detect no increase in interference when I connected the PC to the TS-940S as described, even with the simple home-brew level converter. When the radio sends information to the PC, there may be a slight, detectable signal for a brief fraction of a second as the computer reads and processes the serial data stream.

What Else Can You Do?

The hardware interface described in this article is complete, but the software only scratches the surface of what you can do. I encourage you to use the program to experiment with how your radio accepts and responds to commands. Once you have a feel for how this software works, you can use it as the basis for:

- a logging program that gets frequency and mode data directly from your radio,
- a program that stores station call and frequency information for SWL stations on PC disk,
- a contest program that stores frequency information for stations you've heard but want to return later to contact,
- a satellite program that calculates satellite passes and tunes your radio—and even, with some additional hardware, positions your antennas,
- a packet program that allows you to select the frequencies of HF and VHF bulletin boards, and
- programs that only you can imagine as you use the power of your computer and radio to enhance your favorite modes of ham radio operation.

MODEL SG-2000 HF SSB RADIOTELEPHONE
GLOBAL COMMUNICATIONS FOR DATA AND VOICE

Most hams would never subject our SG-2000 all frequency HF transceiver to the kind of extreme conditions we designed it for. You'd likely be satisfied having 150 watts output, 644 ITU channels, 100 user defined (ham) frequencies in memory plus a direct entry VFO with 10 Hz stability, full frequency coverage, CW with sidetone and a superb 2:1 IF shape factor. Features such as FCC Type Approval, made with pride in America, direct Weatherfax support, up to 8 control heads and full performance from −22F to +140F might seem a bit extreme. But if you've ever chewed the rag on 20 meters in a Force 9 Arctic gale, you'll appreciate that there's a difference between extreme performance and performance in the extremes.

EXTREME PERFORMANCE

SGC Building, 13737 S.E. 26th St. PO box 3526 Bellevue, WA 98005 USA, Telex: 328834, Fax: 206-746-6384 Tel. (206) 746-6310

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NRD-535

THE NEXT GENERATION IN HIGH-PERFORMANCE HF RECEIVERS

Once again JRC breaks new ground in shortwave receiver design. The new NRD-535 has all the features SWLs and amateurs have been waiting for. General coverage from 0.1 to 30 MHz in AM, USB, LSB, CW, RTTY, FAX and Narrow FM modes. Advanced ECSS operation for phase-lock AM reception. Variable bandwidth control (BWC). Tuning accuracy to 1 Hz possible with direct digital synthesis. 200 memory channels with scan and sweep operation. Triple Superheterodyne receiving system. Superb sensitivity, selectivity and image rejection. Dual-width noise blanker eliminates impulse noise. Squelch, RF Gain, Attenuator, AGC and Tone controls. Optional RTTY demodulator available. 24 hour clock/timer. Easy to read vacuum fluorescent display with digital S-meter. AC and DC operation. Plus the most comprehensive computer interface found on any radio to date. Call or write today for a full color brochure, price list and dealer information.

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Tel.: (212) 355-1180 FAX: (212) 319-5227 Telex: 961114 JAPAN RADIO NYK

73 Review

by Dick Goodman WA3USG

LOGic Jr. and LOGic II Vers. 2.1 Ham Logging Software

Discover the versatility of a computerized logbook.

Personal Database Applications
2616 Meadow Ridge Dr.
Duluth GA 30136-6037
Telephone: (404) 242–0887; Fax: (404) 449–6687
Price Class: LOGic Jr. $39; LOGic II Vers. $79.

LOGic Jr. and LOGic II from Personal Database Applications are state-of-the-art integrated database management systems dedicated to amateur radio logging. LOGic Jr. is the entry level program and will enable the user to get started with his or her logging requirements. This review will cover the major aspects of both as used on the IBM-PC. LOGic is also written for the Commodore Amiga and the Atari ST. The user's manual also states that a Mac version will soon be available.

The LOGic logging system is extremely user friendly. Even the uninitiated computer user will be able to start basic logging within a few minutes after installation. As knowledge of the system increases, virtually any type of logging function imaginable can be implemented. Supported functions of LOGic Jr. include:

1. Logging in real time (auto entry of date/time) and non-real time;
2. Auto logging of data from previous QSOs;
3. Automatic tracking of virtually any award;
4. QSL management;
5. User-definable fields in the log;
6. Extremely versatile print function, prints log reports, awards progress, beam headings, QSL Cards and labels;
7. Up to 20 pages of free-form notes/comments stored per QSO.

If LOGic II is purchased, the following functions are included:

1. Interface capability to most computer controlled rigs; logs mode, frequency and band;
2. Control of the radio with full screen memory display;
3. Auto duping and scoring for almost any contest including user generation of contest parameters;
4. Menu-driven report writer, enabling design of your own customized printouts, labels, and QSL cards;
5. QSL database manager facility;
6. Grayline propagation chart;
7. Control of any antenna rotor with RS-232 interface capability.

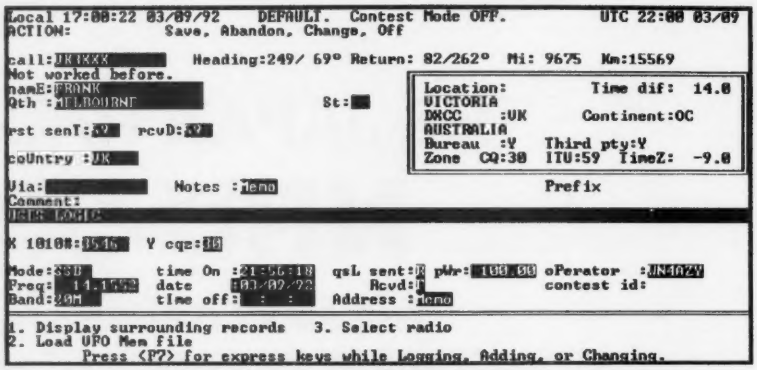


Photo A. LOGic's logging screen. This is only one of many possible configurations.

Some Background

The LOGic logging system was written in "DBMAN," a commercially available applications development system. This system is used by many large corporations and government agencies for the creation of large integrated database management applications used in PC environments. Using a system such as this keeps the developer from "re-inventing the wheel" because many subroutines and functions are included with the development system and do not have to be written "from scratch." Since these functions are utilized in programs written by different developers, they are proven reliable many times over. I have seen programs, logging and otherwise, that did not execute reliably because they were not tested adequately! Since I write software for a living myself, I feel that those with a good degree of computer literacy will find this an important factor in deciding whether or not to purchase any software package.

Incidentally, some of the DBMAN commands and functions are available for use even if you don't have a copy of the DBMAN language. This will allow extensive global updating and diverse manipulation of your database. Be careful, however, because some commands, such as "ZAP," will totally erase a database in one fell swoop! Ensure that your database is backed up before you experiment, but by all means experiment. This is one system that is limited only by your imagination!

Installation

The IBM version of the LOGic system may be ordered on any IBM compatible media (360K, 720K, 1.2M, or 1.44M disks). I received mine on two 1.2M floppy disks. The system requires a hard drive to run. The "LOGic Main Disk" has the installation file on it. You are required to make a directory on your hard drive where the LOGic system will reside, and then to run the installation program. The documentation is excellent. With LOGic II, two manuals are provided. The first is approximately 80 pages long and covers all aspects of installation and use of LOGic Jr. and LOGic II. The second manual is applicable to the "Report Writing" function of LOGic. Both documents are high quality, desktop published manuals with the camera ready copy being at least laser-print quality. These manuals are the highest quality software documentation that I have reviewed to date! Finally, LOGic requires 450K of free memory to execute.

Installation on my 80286-based machine went smoothly and was precisely documented in the user's manual. After installation, a series of menus are presented. These allow the setting of station parameters such as callsign, location (latitude and longitude), offset to UTC, screen colors, screen configuration, and selection of fields that you want to have a default value in your log. Once these parameters are installed, you can begin logging.

Operation

Using this system is as easy as entering the logging screen from the main menu and typing in the information. I found the default data entry screen to be well designed and quite striking in its layout. When a callsign is en-

GaAs FET PREAMPS

at a fraction of the cost of comparable units!

LNG-(*)

ONLY **$59** wired/tested

FEATURES:
- **Very low noise:** 0.7dB vhf, 0.8dB uhf
- **High gain:** 13-20dB, depends on freq
- **Wide dynamic range** - resist overload
- **Stable:** low-feedback dual-gate FET

**Specify tuning range: 26-30, 46-56, 137-150, 150-172, 210-230, 400-470, 800-960 MHz.*

LNW-(*) MINIATURE PREAMP

ONLY **$29** kit, **$44** wired/tested

- GaAs FET Preamp similar to LNG, except designed for **low cost & small size.** Only 5/8"W x 1-5/8"L x 3/4"H. Easily mounts in many radios.

**Specify tuning range: 25-35, 35-55, 55-90, 90-120, 120-150, 150-200, 200-270, 400-500 MHz.*

LNS-(*) IN-LINE PREAMP

ONLY **$89** kit, **$119** wired/tested

- GaAs FET Preamp with features similar to LNG series, except **automatically switches out of line during transmit.** Use with base or mobile transceivers up to 25W. Tower mounting brackets incl.

**Specify tuning range: 120-175, 200-240, or 400-500 MHz.*

HELICAL RESONATOR PREAMPS

GaAs FET preamps with 3 or 4 section helical resonators **reduce intermod & cross-band interference** in critical applications. **MODEL HRG-(*),** $80 vhf, $110 uhf. **Specify tuning range: 142-150, 150-162, 162-174, 213-233, 420-470 MHz.*

RECEIVING CONVERTERS

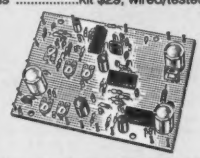
Low noise converters to **receive vhf and uhf bands on a 10M receiver.** Choice of kit with case & BNC jacks, kit less case $49, kit w/case $74, w/t in case $99. *Request catalog for complete listings.*
- **VHF input ranges avail:** 136-138, 144-146, 145-147, 146-148 MHz.
- **UHF input ranges avail:** 432-434, 435-437, 435.5-437.5 MHz.

TRANSMITTING CONVERTERS

XV2 for vhf and XV4 for uhf. Models to convert 10M ssb, cw, fm, etc. to 2M, 432, 435, and for atv. 1W output. **Kit only $89.** PA's up to 45W available. *Request catalog for complete listings.*

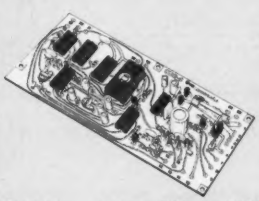
ACCESSORIES

TD-3 SUBAUDIBLE TONE DECODER/ ENCODER. Adjustable for any tone. Designed **especially for repeaters,** with remote control activate/deactivate provisions .....kit $29, wired/tested $69

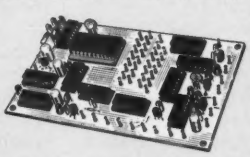


COR-3 REPEATER CONTROLLER. Features adjustable tail and time-out timers, solid-state relay, courtesy beep, and local speaker amplifier .....kit $49

CWID. Diode programmed any time in the field, adjustable tone, speed, and timer, to go with COR-3 .....kit $59



COR-4 kit. Complete COR and CWID all on one board for easy construction. CMOS logic for low power consumption. Many new features. EPROM programmed; specify call kit $99 , w/t $159



TD-2 TOUCH-TONE DECODER/CONTROLLER kit. Full 16 digits, with toll-call restrictor, programmable. Can turn 5 functions on/off. Great for selective calling, too! .....kit $89, wired/tested $149

AP-3 AUTOPATCH kit. Use with above for repeater autopatch. Reverse patch and phone line remote control are std .....kit $89, wired/tested $149

AP-2 SIMPLEX AUTOPATCH Timing Board kit. Use with above for simplex operation using a transceiver .....kit $39

MO-202 FSK DATA MODULATOR kit. Run up to 1200 baud digital signals through any fm transmitter with full handshakes. Radio link computers, telemetry gear, etc. .....kit $49, w/t $79

DE-202 FSK DEMODULATOR kit. For receive end of link. .....kit $49, w/t $79

9600 BAUD DIGITAL RF LINKS. Low-cost packet networking system, consisting of new MO-96 Modem and special versions of our 220 or 450 mHz FM Transmitters and Receivers. Interface directly with most TNC's. Fast, diode-switched PA's output 15 or 50W.

If you always thought a microprocessor-controlled repeater had to be expensive, LOOK AGAIN! You could easily spend this much just for a controller.

REP-200 REPEATER

A premium repeater with autopatch and many versatile dtmf control features at *less than many charge for a bare-bones repeater!* We don't skimp on rf modules, either! Check the features on R144 Receiver, for instance: GaAs FET front-end, helical resonators, sharp crystal filters, hysteresis squelch.

Kit $1095; w/t only $1295!

Other models available:

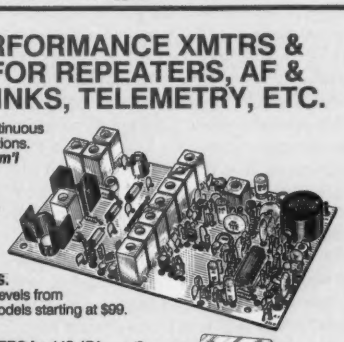
REP-200V Economy Repeater Kit. As above, except uses COR-4 Controller without DTMF control or autopatch. **Kit only $795.**

REP-200N Repeater with no controller. For use with external controller, such as those made by ACC. **Kit only $695, w/t $995.**

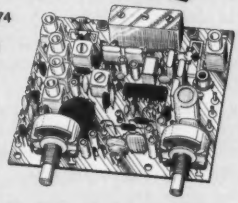
- Available for the 143-174, 213-233, 420-475, 902-928 MHz bands. ***FCC type accepted for commercial service** (vhf and uhf).*
- **Rugged exciter and PA**, designed for continuous duty.
- Power out 15W (25W option)143-174 MHz; 15W 213-233; 10W uhf or 902-928MHz.
- Accessory add-on PA's available with **power levels up to 100W.**
- **Six courtesy beep types**, including two pleasant, sequential, multi-tone bursts.
- **AUTOPATCH**: either **open or closed** access, **toll-call restrict**, auto-disconnect.
- **Reverse Autopatch:** two types, auto-answer or ring tone on the air.
- Pulse (rotary) dial option available.
- **DTMF CONTROL**: over 45 functions can be controlled by touch-tone. Separate 4-digit control code for each function, plus extra **4-digit owner password**.
- **Owner can inhibit** autopatch or repeater, enable either open- or closed-access for repeater or autopatch, and enable toll calls, reverse patch, kerchunk filter, site alarm, aux rcvr, and other options, including two auxiliary external circuits.
- The cwid message, dtmf command codes, and owner-specified default parameters for cor and cwid timers and tones are burned into the eprom at the factory.
- Cw speed and tone, courtesy beep and tail timers, and courtesy beep type **can all be changed at any time** by owner-password-protected dtmf commands.
- **Auxiliary receiver input** for independent control or **cross linking repeaters**.
- Many **built-in diagnostic** & testing functions using microprocessor.
- Color coded led's **indicate status** of all major functions.
- **Welded partitions** for exciter, pa, receiver, and controller. PEM nuts hold covers.
- 3-1/2 inch aluminum rack panel, finished in eggshell white and black.

HIGH PERFORMANCE XMTRS & RCVRS FOR REPEATERS, AF & DIGITAL LINKS, TELEMETRY, ETC.

FM EXCITERS: 2W continuous duty. TCXO & xtal oven options. ***FCC type accepted for com'l high band & uhf.***
- **TA51**: 143-174, 213-233 MHz ...kit $109, w/t $189.
- **TA451**: 420-475 MHz ...kit $109, w/t $189.
- **TA901**: 902-928 MHz, (0.5W out); w/t $219.
- **VHF & UHF AMPLIFIERS.** For fm, ssb, atv. Output levels from 10W to 100W. Several models starting at $99.



FM RECEIVERS:
- **R144/R220 FM RECEIVERS** for 143-174 or 213-233 MHz. **GaAs FET** front end, 0.15uV sensitivity! Both crystal & ceramic if filters plus **helical resonator** front end for exceptional selectivity: >100dB at ±12kHz (best available anywhere!) Flutter-proof hysteresis squelch; afc tracks drift. ...kit $149, w/t $219.
- **R451 FM RCVR**, for 420-475 MHz. Similar to above. ...kit $149, w/t $219.
- **R901 FM RCVR**, for 902-928MHz. Triple-conversion, GaAs FET front end. ...$169, w/t $249.



- **R76 ECONOMY FM RCVR** for 28-30, 50-54, 73-76, 143-174, 213-233 MHz, w/o helical res or afc. ...Kits $129, w/t $219.
- **R137 WEATHER SATELLITE RCVR** for 137 MHz. Kit $129, w/t $219.

- **For complete info, call or write for free catalog.**
  Send $2 for overseas air mail.
  For casual interest (U.S. only), check reader service; allow 3-4 weeks.
- **Order by mail, fax, or phone** (9-12, 1-5 eastern time).
- **Min. $5 S&H charge** for first pound plus add'l weight & insurance.
- **Use VISA, Mastercard, check, or UPS C.O.D.** ($5 fee).

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CIRCLE 57 ON READER SERVICE CARD

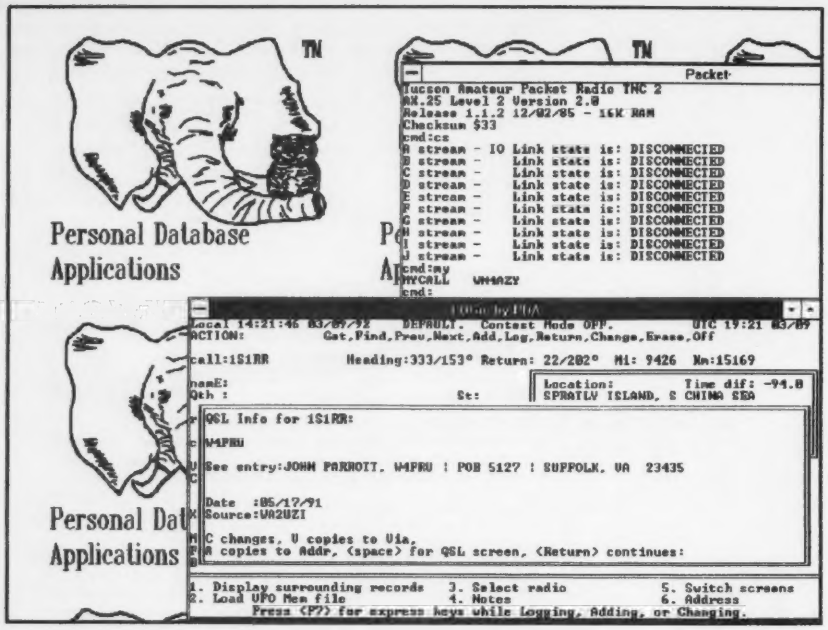
Personal Database
Applications
Tucson Amateur Packet Radio TNC 2
Checksum $33
cmd:cs
A stream - IO Link state is: DISCONNECTED
B stream - Link state is: DISCONNECTED
C stream - Link state is: DISCONNECTED
D stream - Link state is: DISCONNECTED
E stream - Link state is: DISCONNECTED
F stream - Link state is: DISCONNECTED
G stream - Link state is: DISCONNECTED
H stream - Link state is: DISCONNECTED
I stream - Link state is: DISCONNECTED
J stream - Link state is: DISCONNECTED
cmd:my
MYCALL WH4AZY
cmd:
ACTION: Cat,Find,Prev,Next,Add,Log,Return,Change,Erase,Off
call:1S1RR Heading:333/153° Return: 22/202° Mi: 9426 Km:15169
Location: Time dif: -94.0
SPRATLY ISLAND, S CHINA SEA
QSL Info for 1S1RR:
W4PRU
See entry:JOHN PARROTT, W4PRU : POB 5127 : SUFFOLK, VA 23435
Date :05/17/91
Source:VA2UZI
C changes, V copies to Via,
A copies to Addr, <space> for QSL screen, <Return> continues:
1. Display surrounding records 3. Select radio 5. Switch screens
2. Load UFO Mem file 4. Notes 6. Address
Press <F?> for express keys while Logging, Adding, or Changing.

Photo B. LOGic runs under Windows or DesqView. Here LOGic is being run under Windows 3, simultaneously with an external packet program.

tered, a window pops up identifying the location of the station, its continent, time difference, time zone, DXCC prefix, CQ zone, ITU, whether the country is supported by the QSL bureau, and if third party traffic is permitted. On the top of the screen, the short and long path beam headings are displayed, along with the distance to the station. LOGic also informs you if you have worked the station before. If you are using one of the many transceivers with a computer interface, automatic logging of mode, frequency, and band may be accomplished. Complete remote control of the radio is also possible. LOGic will automatically aim your antenna at either the long or short path directions at the touch of a function key if you have a rotor with an RS-232 interface (I did not review the radio interface or antenna aiming function).

While entering data, on-line help is available for each field by pressing the appropriate function key. LOGic also utilizes intelligent edit criteria to minimize errors in data entry. Input of band, mode, state, and several other parameters are checked against internal tables for valid values. All data in these tables may be modified by the user. For example, changing the values of frequencies in the band table for your license class will enable LOGic to warn you if you are operating out of your allocated frequency range.

Screens may be modified for virtually any contest and called up instead of the default screen. LOGic includes screens for almost all major contests already formatted and ready to select via the Select Screen Configuration Menu. LOGic also provides for automatic incrementing of contest serial number, dupe checking, and multiplier tracking. When contest data is entered, it may be merged in with your existing log, or easily removed at the completion of the contest.

Inquiry and locating data in LOGic is simple and fast. LOGic uses indexed files for both date and callsign. No matter how large the database becomes, inquiry by call or date (or partial call or date), is effectively instantaneous. LOGic also will allow inquiry via sequential file search of any field (or any character string within a field). While this is not immediate (and takes longer as the database becomes larger), I found that with a log with 1,800 entries I could search any field within 20–30 seconds. Display of multiple records on one screen is also possible. In this format, it emulates the ARRL logbook configuration.

LOGic's report generation facility is menu-driven and *superb* (it also comes with its own 60-page manual). It contains many pre-configured reports that will probably satisfy most requirements. Tabular reports, envelopes, QSL labels, and several other normal logging formats are provided. These reports may be modified or other reports created from scratch if desired.

LOGic even includes a mail merge capability. This will allow you to generate letters and personalize them with data from your logging database.

If you are presently using another logging program, chances are that LOGic will allow you to import data from it. LOGic comes with programs to import data from K1EA CT (through Version 7), ARIES-1 and 2, HAMRAD, KT5X Contest Logging program, and Swisslog. LOGic will also import data from DBASE III files, standard ASCII fixed-length (SDF) files, or comma-delimited ASCII files. Unless your present logging system uses some really non-standard, proprietary storage format, it should be capable of being imported into LOGic.

Awards Tracking

LOGic really shines when it comes to tracking awards. This system will display your status in virtually any major award in existence. LOGic comes ready to track WAS, DXCC, WAC, WAZ, 10-10 numbers, County Hunting, and Russian Oblasts. Others may be added as you get more familiar with the software. The only thing that you have to be especially careful about when tracking awards is to ensure that your latest QSL information is correctly input.

LOGic derives all other necessary parameters such as ITU zone, CQ zone and DXCC country name from its large prefix tables (greater than 3,800 entries!). For WAS and 5BWAS, LOGic uses the two character state code that you enter during the logging process. This state code is checked in tables to ensure accuracy as you enter it. After I had imported in excess of 1,800 log entries from a DBASE III based logging system, LOGic built all necessary awards tables and indices in a matter of two minutes for a DXCC status report. I did not import the DXCC country name but let LOGic generate that data from its prefix tables. The results were *right on the money*, all stations worked were located in the prefix tables and the report sent to my printer.

The report displays callsign, country name, date and time worked, frequency, mode, QSL status, and signal exchange. Upon completion, a summary is generated showing total stations reported worked and a confirmed/non-confirmed ratio using QSL status data. The report is well formatted and very useful (I didn't realize how far I still was from getting DXCC!).

Final Kudos

While LOGic does not contain a formal packet cluster interface, a small communications terminal program is included that will run in the background with LOGic and allow access to your TNC.

LOGic also has a comprehensive database of QSL managers. This is updated on a periodic basis and is available as an option to the user. LOGic even has a built-in contest keyer for sending CQs and repetitive data during CW contests!

In summary, I found LOGic fast, easy to use, and perhaps most important, reliable. It is a serious logging program for those who want to document more then "Hello and Goodbye" QSOs. The capability to add tailored fields and virtually unlimited remarks allows the user to effectively design his/her own logging system without having to learn a high level computer language. My suggestion is that if you're in the market for a state-of-the-art computer logging system, give LOGic a try. You will not be disappointed. 73

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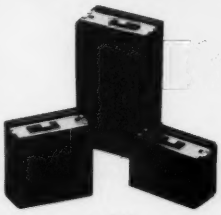

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CIRCLE 191 ON READER SERVICE CARD

73 Review *by David Cassidy N1GPH*

Daiwa PS-304 Regulated Power Supply

Electronics Distributors Corp.
325 Mill St.
Vienna VA 22180
Telephone: (703) 938–8105
Price Class: $170

I have never really thought much about acquiring a testbench power supply before. All of my DC power supply needs have been served by standard 12V supplies, with the current rating to match whatever equipment I was running.

Recently, I've been doing a lot of circuit building. Testing out different circuits is difficult or, if you need other than standard 12V, impossible to do with a power supply designed to just sit there and quietly give you 12V. To aid in my circuit and component testing, I picked up a Daiwa PS-304 regulated DC power supply. I have to admit, now that I have one, I don't know how I survived 20 years of hamming without it.

Up Front

The PS-304 is a rock-solid piece of gear. It provides variable DC voltage from 1V to 15V, and current up to 30 amps intermittent (1 minute on/3 minutes off) and 24 amps continuous (enough to power most HF rigs). A heavy-duty, enameled cabinet and firm, quality switches and connectors give the feel of a professional piece of test equipment. Being a testbench supply, all dials, switches and connectors are on the front panel (unlike your basic 12V supply, where the connections are usually placed on the back).

The face of the PS-304 is dominated by a voltage/amperage meter, switchable between the two by a rocker switch. This allows you to set the voltage to exactly what you need, as well as measure the current draw of a circuit or piece of gear. Voltage is easily set with a rotary knob.

What makes the PS-304 such a convenient power supply to use is the abundance of power connections available. There is a set of screw posts providing up to 30 amps, two sets of spring clips that provide up to 6 amps, and a standard cigarette lighter socket that provides up to 10 amps. This socket also has a tight-fitting cover plate, to keep dust out when not in use. Those who use cigarette lighter plugs to power their mobile gear will especially appreciate this feature.

Documentation

As you might expect, a power supply doesn't require an instruction book to operate it. Even so, the one-page instructions that come with the PS-304 are the hands-down winner for the "Bad Japanese Translation of the Year" award. I actually laughed out loud at some of the twisted syntax and unique sentence construction (not to mention the typographical errors). Since it doesn't take a rocket scientist to operate a power supply, it is easier to be amused in this case than in some others, but the point must be made: When are foreign companies going to start hiring English-speaking writers to supply them with English instructions? Even the most complex instruction manual could be rewritten in about a day, working from someone's bad translation. A single-page instruction sheet would take about 10 minutes to proofread and correct. In this day of desktop publishing and instant printing, this type of carelessness should cease.

Thumbs Up

Most power supplies are set up and then forgotten. You stick them under a desk, or on the back of a shelf, and as long as they don't break down you never give them another thought. The PS-304 is definitely NOT that kind of power supply. If you have varying power needs, or if you do even a modest amount of kit building or home-brewing, you will find this power supply fills your needs beautifully. The quality of construction and ease of use make this a superb addition to any ham's testbench. 73

Food for thought.

Our new Universal Tone Encoder lends its versatility to all tastes. The menu includes all CTCSS, as well as Burst Tones, Touch Tones, and Test Tones. No counter or test equipment required to set frequency-just dial it in. While traveling, use it on your Amateur transceiver to access tone operated systems, or in your service van to check out your customers' repeaters; also, as a piece of test equipment to modulate your Service Monitor or signal generator. It can even operate off an internal nine volt battery, and is available for one day delivery, backed by our one year warranty.

- All tones in Group A and Group B are included.
- Output level flat to within 1.5db over entire range selected.
- Separate level adjust pots and output connections for each tone Group.
- Immune to RF
- Powered by 6-30vdc, unregulated at 8 ma.
- Low impedance, low distortion, adjustable sinewave output, 5v peak-to-peak
- Instant start-up.
- Off position for no tone output.
- Reverse polarity protection built-in.

Group A

67.0 XZ	91.5 ZZ	118.8 2B	156.7 5A
71.9 XA	94.8 ZA	123.0 3Z	162.2 5B
74.4 WA	97.4 ZB	127.3 3A	167.9 6Z
77.0 XB	100.0 1Z	131.8 3B	173.8 6A
79.7 SP	103.5 1A	136.5 4Z	179.9 6B
82.5 YZ	107.2 1B	141.3 4A	186.2 7Z
85.4 YA	110.9 2Z	146.2 4B	192.8 7A
88.5 YB	114.8 2A	151.4 5Z	203.5 M1

- Frequency accuracy, ± .1 Hz maximum - 40°C to + 85°C
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TEST-TONES:	TOUCH-TONES:	BURST TONES:
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1000	770 1336	1650 1900 2200 2450
1500	852 1477	1700 1950 2250 2500
2175	941 1633	1750 2000 2300 2550
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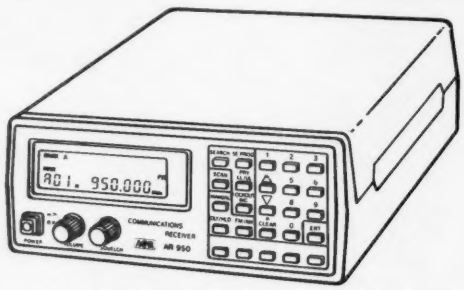
Options:

External Speaker. Mobile Mount.	MS190	$19.50
Extended Warranty. 2/3 yrs		$45/$55

Specifications:

Coverage:	8-600, 805,1300MHz
Sensitivity:	.35uV NFM, 1.0uV WFM, 1.0AM
Speed:	20 ch/sec. scan. 40 ch/sec. search
IF:	561.225, 58.075, 455KHz or 10.7MHz
Increments:	5 to 955KHz selectable/ 5 or 12.5 steps.
Audio:	.4 Watts
Power:	Input 9 - 13.8 V. DC
Antenna:	BNC
Display:	LCD
Dimensions:	6 7/8H x 1 3/4D x 2 1/2W. 12oz wt.

AR950 $289



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Coverage:	27-54, 108-174, 406-512, 830-950MHz
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Scan Speed:	15 ch/sec.
IF:	21.4MHz, 455KHz
Increments:	10,12.5,25,30
Audio:	1W
Power:	12.8VDC, 200MA
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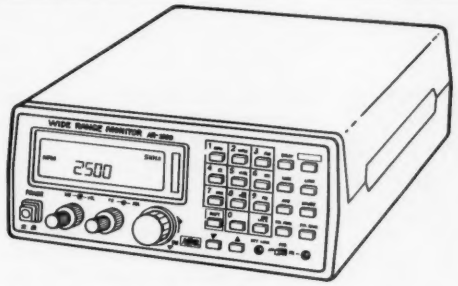

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- One Year Limited Warranty.

Options:

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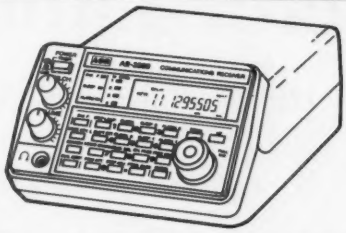
Extended Warranty. 2/3 yrs.		$65/75
Mobile Mounting Bracket.	MM1	$14.90
RS232 Control Package (software & cable) offers spectrum display and database.	SCS2	$295.00

Specifications:

Coverage:	1 MHz - 1500MHz
Sensitivity:	.35uV NFM, 1.0uV WFM, 1.0AM/SSB/CW
Speed:	38 ch/sec. scan. 38 ch/sec. search
IF:	750.00, 45.0275, 5.5MHz 455KHz
Increments:	5,12,5,25 KHz
Audio:	1.2 Watts at 4 ohms
Power:	Input 13.8 V. DC 300mA
Antenna:	BNC
Display:	LCD, backlighted.
Dimensions:	2 1/4H x 5 5/8W x 6 1/2D Wt. 1lb.

AR3000 $1095



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- 15 band pass filters, GaAsFET RF amp.
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- AC adaptor/charger. DC power cord.
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Options:

Earphone.	EP200	$2.00
External Speaker. Mobile Mount.	MS190	$19.50
Extended Warranty. 2/3 yrs.		$65/75
Mobile Mounting Bracket.	MM1	$14.90
RS232 Control Package (software & cable) offers spectrum display and database.	SCS3	$295.00

Specifications:

Coverage:	100KHz - 2036MHz
Sensitivity:	.35uV NFM, 1.0uV WFM, 1.0AM/SSB/CW
Speed:	20 ch/sec. scan. 20ch/sec. search
IF:	736.23, (352.23) (198.63) 45.0275, 455KHz
Increments:	50Hz and greater
Selectivity:	2.4Khz/-6db (SSB) 12KHz/-6db (NFM/AM)
Audio:	1.2 Watts at 4 ohms
Power:	Input 13.8 V. DC 500mA
Antenna:	BNC
Display:	LCD
Dimensions:	3 1/7H x 5 2/5W x 7 7/8D Wt. 2lb 10oz.

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DXpedition Lessons from Peter I and Bouvet Islands

Helpful hints for your next exotic radio operation.

by Roald Steen AJØN/LA6US

Few amateurs have as much experience in arranging DXpeditions to difficult locations as Kaare Pedersen LA2GV and Einar Enderud LA1EE. In January 1987 this two-man team of Norwegian DXpeditioners were the first ones to put 3Y2, Peter I Island, on the air. Two years later, they conducted another memorable DXpedition, this time to 3Y5, Bouvet Island. The Peter I Island expedition of LA1EE and LA2GV resulted in 16,000 contacts with 112 countries; the Bouvet Island expedition of LA1EE, LA2GV, F2CW, HB9AHL and JF1IST resulted in a total of 47,000 contacts with hams on all continents.

I met with Kaare and Einar in November 1990 at Einar's spacious hilltop home in an Oslo suburb, and talked with them about their DXpeditions to Peter I and Bouvet Islands. Their experiences in planning and conducting these two difficult DXpeditions can be a helpful guide to other groups of hams that may be planning DXpeditions to DXCC countries that are hard to get to.

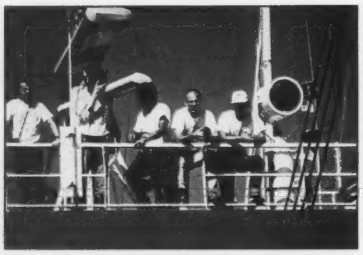

Photo A. Jacky F2CW, Einar LA1EE, Jin JF1IST, Kaare LA2GV and Willy HB9AHL aboard the M/V Aurora.

Plan Ahead

Einar had Arctic experience from serving as the manager of a satellite communications facility on the Svalbard Islands, north of Norway, before embarking on the first DXpedition to Peter I Island. His knowledge of Arctic conditions was an important asset during the expedition planning.

Concern for the weather and the seasons must be part of the planning for an expedition to a remote island such as Bouvet or Peter I, Einar explained. Peter I Island is covered with fog during much of the year, so even a helicopter may be unable to land there much of the time. In the far south, you must plan your DXpedition for the northern winter to avoid the severe weather that much of this part of the world experiences during the southern winter.

Most of all, if you would like to arrange a DXpedition to a remote uninhabited island, you will need funds. A DXpedition to an inhabited tropical island in the Caribbean or the Pacific may not cost much more than a regular vacation, but an uninhabited island is likely to lack all infrastructure such as roads, shelters, airport and utilities.

In common with a few other rare DX countries, Bouvet Island and Peter I Island are both completely uninhabited. Once you are dealing with an uninhabited island when planning a DXpedition, everything becomes much more expensive and complicated. As uninhabited islands, both Bouvet and Peter I are without service by any airline. If you would like to operate from an uninhabited island like 3Y2 and 3Y5, you must arrange your own transportation, and this can be far more expensive than flying to your destination as a passenger on a commercial airline.

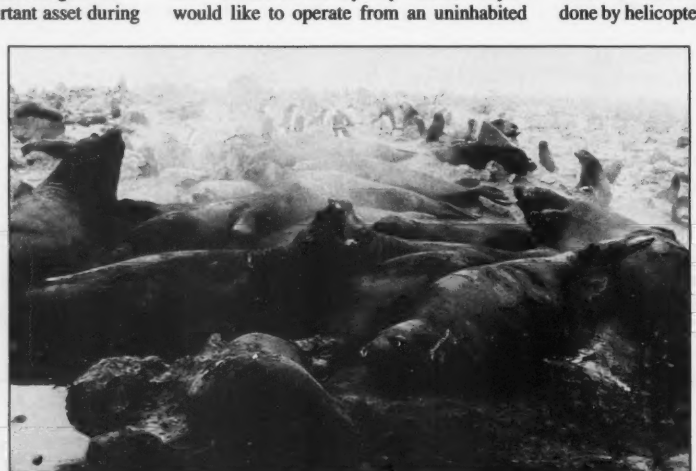

Photo B. The inhabitants of Bouvet Island are elephant seals and penguins.

Getting There

The Norwegian polar vessel *Aurora* transported Einar and Kaare during their Bouvet and Peter I Island expeditions. The *Aurora* is equipped for polar voyages, and has a crew which is well experienced in navigating in polar regions and in dealing with severe weather conditions.

On an uninhabited island, all of the amenities which you are used to are missing. Since there is no electric power, you must bring your own generator. Fuel for the generator must be brought onto the island, for you will not find a fuel dealership on an uninhabited island.

Bring Plenty of Supplies

And there are other problems. You must bring your own food for the duration of the stay. You may even have to bring your own water or desalination equipment.

Once you finally get there, landing on Bouvet Island or Peter I Island can be a challenge. There are no docks or natural harbors on either of these islands, so landing must be done by helicopter. But, in order to be able to get off the island if the helicopter should malfunction or if visibility should become too low for safe helicopter evacuation, there must also be a way to get off the island by boat or rubber raft in an emergency.

If Kaare and Einar should have been unable to leave Peter I Island by helicopter, they would need to use some mountain climbing techniques. They set up their station on top of a glacier which could only be descended with the help of ropes and mountain climbing gear. Peter I Island has few sites that are suitable

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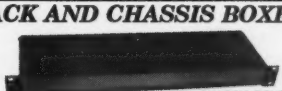

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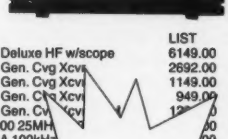

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for access even by helicopter, and the glacier site turned out to be the most convenient site on the island.

For shelter, Kaare and Einar brought tents that were built for use in polar regions. These tents have special insulation between two layers of fabric to keep the cold out.

A Well-Equipped Station

The Bouvet Island expedition was well equipped with radio equipment. In addition to Kaare and Einar, the operator team consisted of Jacky F2CW, Willy HB9AHL and Jin JF1IST. The guest operators also helped in raising funds for the expedition. During the Bouvet Island expedition, the considerable inventory of radio equipment included four triband beams, three Butternut HF-6V verticals and a W0CD Battlecreek Special antenna for 40, 80 and 160 meters, and five transceivers.

Even a portable computer was included to assist in logging. Some interference between the five stations on Bouvet Island was inevitable, since the separation between each station was small. By planning the bands to be used by each station to limit interference, and by using antennas with vertical polarization at some of the stations and horizontal polarization at the remaining ones, interference was kept at tolerable levels.

Licensing

Some rare DX countries are islands that are politically or militarily sensitive, perhaps with a host government which is not too friendly to amateur radio. Fortunately, the Norwegian government is friendly to amateur radio and does not consider these remote islands under its administration to have any strategic value. Reciprocal operating agreements exist between Norway and most countries with a large ham population.

It is even questionable if the Norwegian government could deny anyone permission to land on Peter I Island, since this island is so far south that it is covered by the Antarctic Treaty. The Antarctic Treaty includes guarantees of free access to the continent and the islands that are covered by the treaty to anyone, regardless of nationality.

The Norwegian government has turned Bouvet Island into a natural reservation due to its unique nature and wildlife, mostly composed of elephant seals and penguins. Therefore, it granted Einar and Kaare permission to land on the island provided that they left the island as it was when they arrived there. All garbage and equipment had to be removed when the expedition left Bouvet Island.

Photo C. Erecting a triband yagi on Peter I Island. This was the very first radio operation from this island near the Antarctic continent.

Mutual Benefits

But the DXpedition was asked to leave two artifacts on Bouvet Island. One is an automated weather station, which sends its reports through a French communications satellite system. The weather station, which is not solar powered, has batteries that are designed to last for three years. A plaque of Lars Christensen, a Norwegian ship owner who financed the expedition which claimed Bouvet Island on behalf of Norway in 1927, was also left behind, mounted on a large rock near the camp on Bouvet Island.

An amateur radio operation can provide the island and the host government with a great deal of publicity. And this is the type of publicity which governments like, as ham radio is a peaceful hobby which conveys an image of advanced technology. An event of this type may also be attractive to corporate sponsors that are seeking publicity. Large corporations may be persuaded that they can benefit from sponsoring a DXpedition with its image of advanced technology.

Finding Sponsors

Kaare and Einar utilized these forces during their fund-raising efforts for their two DXpeditions. They received funding from corporate sponsors in a number of countries. They also received contributions from the almost 1,000 amateur radio operators around the world that are members of Club Bouvet.

A television crew followed the expedition to Bouvet Island and took more than seven hours of TV footage. This footage has been edited into television programs that have appeared on European television. Researchers from the World Wide Fund for Nature (WWF) and the Norwegian Polar Research Institute followed the Bouvet Island DXpedition as paying expedition members.

The Peter I Island expedition, on the other hand, was arranged by the Norwegian Polar Research Institute. Kaare and Einar participated in that expedition as paying expedition members to set up their ham radio operation on the island.

If you are planning a DXpedition to a rarely visited location, revenues from television footage may help you balance the books. Kaare and Einar have not put their experiences into a book, being too occupied with their engineering professions in Norway, but a trip like this could also provide good material for a book to earn some additional revenues.

Remote DX Adventures

It may help to be in good physical condition before you start out on a DXpedition to an uninhabited island. And last, but not least, you will need support from other amateur radio operators in the form of fund raising, QSL managers and a support organization, according to Kaare and Einar.

Photo D. Einar LA1EE starting up the generator on Peter I Island.

Photo E. The rugged campsite on Bouvet Island. The M/V Aurora *can be seen in the background.*

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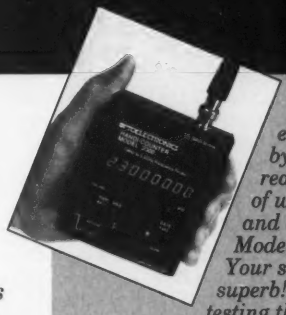

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73 Review *by Michael Jay Geier KB1UM*

The Yaesu FT-26 2 Meter Walkie

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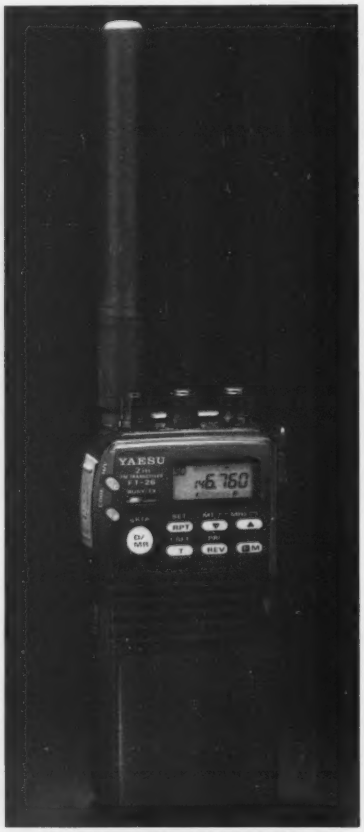
Yaesu's new FT-26 is the successor to the company's venerable FT-23R series. It's an attractive little walkie that follows today's trend of making the cases thicker while reducing the other dimensions. Its rounded, sculpted shape feels good and fits nicely in my hand.

First Impressions

Although Yaesu's ads show the FT-26 with its standard 7.2-volt battery, the review unit was shipped with the optional 12-volt battery, making it substantially larger than it looks in the magazines. The radio itself is quite small, and the entire package is comparable to other small, modern walkies when the standard battery is used. All the buttons are on the front and left side, making the rig easy to operate. The PTT/Lamp/Monitor switch is rubberized and rounded and has a very nice feel. The speaker produces very good audio for a radio this size. It blows away the audio on my FT-411. The LCD resembles the one on the '411, but the new one is larger and significantly easier to read. Like the '411, this one shows all six digits of the operating frequency, including a real zero at the end. It's great. I wish the other manufacturers would go back to this system. The LCD and the keypad buttons are lit with green LEDs. The lights can be locked on, which is nice for mobile operation at night. Also, they can be set to shut off a few seconds after the last button has been pressed, which is optimum for battery operation. Speaking of those buttons, there aren't many of them! In keeping with the advertised philosophy of simplicity, the radio only has nine buttons on the front and three on the side under the rubber cover. Sorry, there's no DTMF (Touch-Tone) pad.

The top of the rig has the usual volume and squelch controls and antenna connector. Each has a rubber gasket to help seal moisture out. Also present are the mike and earphone jacks, of course, but there's an extra goodie here: a direct 12-volt input jack. You don't have to buy an adapter to slide on the bottom of this rig to use it in your car or as a base station; just plug your cable in and go! Nice touch. To complete the mobile picture, a slide-on cover is provided so that you can remove the battery and still protect the connector on the bottom. In this configuration, the entire radio is about the size of a microphone!



The Yaesu FT-26 2 meter walkie.

But, if you do leave your battery connected, it will charge as you drive. That could be very handy on long trips. The rubber duck antenna is extremely stiff. Its rubber cover is not firmly attached to the BNC connector, and mine started to unscrew when I tried to remove the duck from the rig. This antenna could use some improvement. Finally, the rig comes with a belt clip, but no soft case. The cases are available as options, though.

Lotsa Stuff, Easy to Use

Although the radio is indeed simple to use, it does not skimp on features, save for one important one (more about that later). In fact, there are some new, advanced capabilities. Let's see, you've got 53 memories which can be tuned like individual VFOs. Any memory can hold odd splits or independent TX/RX frequencies. There's one real VFO (the "dial"), and there's a "call" memory which is accessed with just one keypress. The rig also has built-in VOX, which is designed to be used with an optional headset. DTMF squelch and paging are standard. CTCSS is available with the FTS-17A tone board, but it's optional and the review unit did not have it installed, so I couldn't try it out. It appears to function in much the same way as the FT-411's, so it should be very easy to use. RF power output can be selected from four different levels when using 12 volts, for a maximum of 5 watts out. At 7.2 volts, three levels are available, with 2 watts being the highest. During transmit, the LCD depicts the power output by showing appropriate numbers of steps at the bottom (where the S-meter is during receive). Note that this is not an actual measurement of power output—it is just a display generated by the microprocessor. On most walkies (which have only HIGH and LOW power settings) this is silly, but it has a purpose here, because it reminds you of which of the four steps you have chosen.

The Automatic Battery Saver (ABS) has a new twist. It monitors your operating history and adjusts itself to the optimum saving ratio without your ever knowing about it! If you don't like that, you can set it manually for three different ratios, or you can turn it off for packet operation.

The Automatic Power Off (APO) function lets you select from 10, 20 or 30 minutes and, of course, permits you to disable it. To save even more power, the BUSY LED, which lights to indicate that the squelch is open or the channel is busy, can be turned off, as can the musical keypad beeper.

The Automatic Repeater Shift (ARS), which sets the offset for you in accordance with the band plan, can be adjusted to various repeater subbands, as well as turned on and off. I surmise that this is used primarily for setting the radio to the subbands of different countries. I can't imagine why you'd want to change it here in the U.S.

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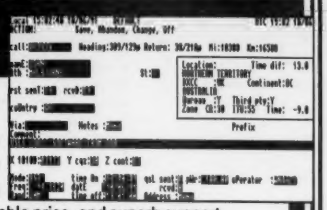

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into a channelized, CB-like unit by selecting the "memory only" mode. In this configuration, only channel numbers, which correspond to memory numbers, are displayed. No frequencies, nothing! Also, most of the rig's features are locked out. This might be useful for a true technophobe's first week of ownership but, beyond that, I don't see the point, especially since you must program the frequencies in first to use it! Perhaps it could be helpful for someone who is physically or visually impaired.

Basics

The radio receives from 130 to 174 MHz and transmits from 140 to 150 MHz. Receive sensitivity is excellent and holds up very well outside the ham bands. Selectivity is as usual for Yaesus. In other words, superb. When you are 5 kHz off, you *know* it.

As I mentioned before, receive audio is very good. The speaker has better bass response than most small rigs, which makes it sound much nicer, especially on male voices. It is reasonably loud for its size but, as you might expect, it can be hard to hear in a noisy car or truck. Of course, you can hold the whole rig up to your ear because it is so small. Also, there are optional speaker/mikes, and even a new earpiece/mike which has a separate mike you clip to your shirt.

The radio has all the usual scanning and priority functions, and it lets you shield memories from the scan while still allowing you to hear them manually. You also may hide them altogether. The scan speed is about the fastest I've ever seen; it really zips through the band.

FT-26 Specifications

General	Frequency Range (MHz)	RX: 130–174 MHz TX: 140–150 MHz	
	Channel Steps	5, 10, 12.5, 15, 20 & 25 kHz	
	Standard Repeater Shift (Resettable)	600 kHz	
	Emission Type	G3E	
	Supply Voltage	5.5–16 VDC	
	Current Consumption	Stand-by (with 1-sec. save)	19 mA
		Receive	190 mA
		Transmit (5W)	1.5A
		Auto Power Off	6 mA
	Antenna (BNC Jack)	YHA-17 Rubber Flex Antenna	
	Case Size (w/FNB-25)	2.2 x 4.6 x 1.3 in. (55 x 116 x 33 mm.)	
	Weight (approx., w/FNB-25)	0.8 lbs.; 380 g.	
Receiver	Circuit Type	Double-conversion superheterodyne	
	Sensitivity (12 dB SINAD)	Better than 0.158 µV	
	Adjacent Channel Selectivity	Better than 60 dB	
	Intermodulation	Better than 65 dB	
	Audio Output (@ 12V)	0.5W @ 8 ohms for 5% THD	
Transmitter	Power Output	5W w/FNB-27; 2W w/FNB-25	
	Frequency Stability	Better than ±10 ppm.	
	Modulation System	Variable Reactance	
	Maximum Deviation	±5 kHz	
	FM Noise	Better than −40 dB @ 1 kHz	
	Spurious Emissions	Better than 60 dB below carrier	
	Audio Distortion @ 1kHz, w/3 kHz deviation	Less than 5%	
	Microphone Type	2-kilohm condenser	

Using It

Because there are so few buttons, some of the more advanced operations require some arcane keypress sequences. Luckily, there aren't too many of them, and none is anything you will use very often. For everyday operation, the radio couldn't be easier to use. While you cannot enter frequencies directly (because there's no number pad), the rotary dial, in conjunction with the MHz step function, lets you get where you're going without too much trouble. Most operation is from the memories anyway. Other than that, there's not much to tell. This is a basic, solid walkie.

What's Up, Docs

In many of my reviews, I've complained bitterly about the incomprehensible documentation. This time, though, there's nothing to complain about. The booklet is first rate. It is written in *English* and, except for a few insignificant typos, is about as close to perfect as I could hope for. Even the section on DTMF squelch and paging is easy to understand. See, it *can* be done. Also included are full schematics and a handy, wallet-sized cheat sheet. Nice job, folks.

Oops...

The DTMF squelch and paging modes require both the sending and receiving of tones, so the rig obviously has a tone-generating chip inside. Despite this, *you cannot make autopatch calls from this radio*. Nor can you use it to control special functions on a repeater. It can only send 3-digit codes, and only zero through nine. It cannot send the star or pound sign. All the new rigs (at least the ones I've seen) which have DTMF paging use the same three-digit, 0–9 scheme. Like the others', the FT-26's inability to send the star and pound sign makes the selective calling features unusable through most modern repeater controllers, which will not pass the tones without prefixes containing the special characters. Of course, it works fine for simplex use and is especially handy at hamfests.

Conclusion

I like this radio. It works well and keeps the "bells and whistles" to a minimum, or at least unobtrusive. If you need the paging or you are turned off by lots of programming options (and can live without autopatch), the FT-26 is for you. If, however, you need the CTCSS or autopatch, check out Yaesu's gorgeous new FT-415, which I'll be reviewing very soon. Either way, Yaesu's got a walkie you're sure to love.

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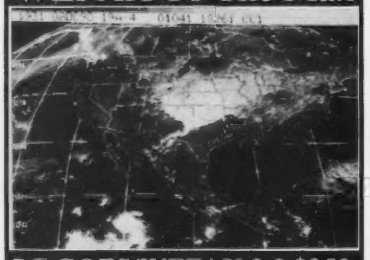

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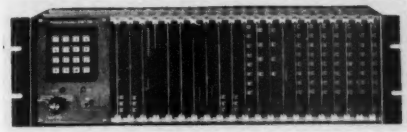

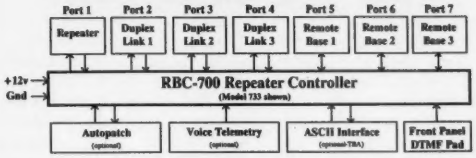

The RBC-700 Repeater Controller is designed to support Repeater systems that require multiple radios connected together at a site. The RBC-700 utilizes a true 7 x 7 audio matrix switch which allows several conversations between ports at the same time. In the illustration above the 733 model is supporting a Repeater, 3 Duplexed Links to different sites, and 3 Remote Bases. Using simple commands, a user could tie the Repeater and a Remote Base to one Link, while the other Links are communicating through your site, holding separate conversations. Or, connect all of the ports together - like a big party line !!

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School Days and Dual-Band J's

Whether you are a new ham or an old-timer, a techie or an appliance op, radio direction finding (RDF) contests can add to your ham radio fun. More and more clubs are adding these events, often called hidden transmitter hunts, foxhunts, or T-hunts, to their monthly calendar of events.

Everyone says that we need more young people in amateur radio. So why isn't everyone making better use of an unbeatable tool (foxhunting) for getting kids interested in our hobby?

At the annual Science Extravaganza, a hobby show put on by the Youth Science Center (YSC) of Orange County, California, we always have RDF demonstrations in addition to the usual HF/VHF/ATV/OSCAR/packet displays. Nothing else gets youngsters excited about radio more than "sniffing out" one of the two hidden T's on the grounds, using the RDF gear we provide.

I'm not a schoolteacher, so I don't get to do this sort of thing regularly. To my dismay, I am finding that far too many non-ham educators are fearful of science and ignorant of ham radio. (YSC is trying to change that!)

All the ham operators who teach in my school district can come up with a dozen reasons why they can't use amateur radio in their classrooms. So I am thrilled to read of educators like WB2JKJ and WB2MGP who are using it in spite of the obstacles. But it can be even better when T-hunting is part of the ham radio curriculum.

Sooner Scholars

Don Loving N5NDE is a science teacher in Burneyville, Oklahoma. Turner High School, which has about 100 students total, is in a rural area near the Texas border. Don has made amateur radio an important part of his physical science class. A dozen teens are now proud owners of ham tickets (see Photo A).

"My kids are more enthusiastic about transmitter hunting than any other radio activity," Don told me. "Ordinary on-air QSO contesting bores them to tears. They like it at first, but they get burned out pretty quickly. Teenagers need something more active, like foxhunting."

The Turner High RDF program is still young, but holds lots of promise. "Right now we're short on equipment," N5NDE reports. "I have a couple of kids assigned to building a Doppler set, and we have obtained the money for parts.

"My kids prefer to be the fox. The adults and anybody else who wants to come out can try to find us. We have already had one walking hunt and one driving hunt."

Support from the ham community would be a big help to a program like this. "We tried to have a couple of contests at the local hamfests," Don says. "At the one at Oklahoma City, we only had a few people show up, one from Texas. We had a good time but we only had three or four people that hunted.

"We don't have any ham clubs close by. There is a repeater within range, and we talk it up on that. Mostly we have to go to hamfests that are a couple of hours away."

Don's plans for the future include using RDF for search and rescue (SAR). He would like to run an SAR Explorer post. "We had a small four-passenger plane crash a few years ago that affected the whole community," he says. "Hams were out searching for the plane. That brought up the idea of SAR in these kids' minds, because they all lost some friends."

We need more hams like Don Loving in education. How about setting up a foxhunting program for your school system? Lack of RDF experience is no excuse—N5NDE didn't have any when he started, either. Here is an opportunity for the teacher to learn along with the students.

Photo A. Turner High School students built a "shrunken quad" to find elusive hidden transmitters. Left to right, they are Andy Barthel KB5ONC, Gregg (no call yet), Rodney Blankenship KB5ONB, and Wes Hearell N5OFA. (Photo by N5NDE.)

You're Never Too Old

Don't get the idea that RDF contesting is just for kids. The dozen T-hunts every month in Southern California bring out fun lovers of all ages. One perennial participant is Milt Ronney WA6FAT (see Photo B). Milt celebrates his 80th birthday this year. He started T-hunting in the 1950s and has never grown tired of it.

In his 35 years of 2 meter DFing, Milt has followed technology, going from an AM "Gooney Bird" to the newest imported rigs. He was part of the hiding team that set the record for longest distance 2 meter hunt (252 air miles). He is also a regular on the monthly 6 meter hunt.

Put a hidden transmitter on the air and chances are Milt will come out to find it. That is, he will if he is not enjoying his other hobby—square dancing with his wife Elizabeth.

A Black Box That Talks

Clever "foxes" like to conceal their transmitter/antenna setups in out-of-the-way nooks and crannies, then talk through them remotely. One easy way is to use a dual-band VHF/UHF transceiver that has been modified for crossband repeat operation. (Information on such modifications is often provided by manufacturers and dealers.)

A typical example is the 2 meter hunt that WA6OPS and I put on for the Orange County (California) RACES group last November. It was intended to be a relatively easy nighttime training exercise, but we wanted to give the contestants something unexpected. Most of them were new to the RDF scene.

I put my IC-32AT 2 meter/70 cm handheld and a 20 amp-hour 12 volt battery in a box, painted black. We concealed this lashup in a bush, a few feet off a dead-end road in Anaheim Hills. We parked our van a couple of blocks away in a good spot to view the bush, but where we could not be seen from the dead end.

Hunt time came, and we began our regular voice transmissions on 446 MHz, repeated onto the 146 MHz hunt frequency by the concealed dual-bander. It took the first team about an hour to DF up to the road end. Not seeing anyone talking into a microphone, they drove off and were not seen again for another hour. Team after team did the same thing, or else sat there, peering at the dead end, expecting to see us crouching in the bushes.

After lots of encouragement from us, most of them got out their flashlights and beat the bushes to find the black box. These fledgling hunters won't soon forget the lesson they learned: Follow your RDF gear and expect the unexpected.

"Homing In" readers around the country have told me of the fun they've had using dual-banders as remotely operated foxes. Mobile dual-banders usually have separate antenna connectors for each band, but the single antenna jack on dual-band HTs can pose a problem. You need an antenna that is better than a "rubber ducky" so the hunters can hear you at the start point, but it has to be effective and a good match on two bands.

For the RACES hunt, I used a 2 meter J antenna. Theory predicted it would work great, and it did. The half-wavelength radiator of a 2 meter J is 3/2-wavelengths on the 70 cm band. It does not have gain toward the horizon, but it works just fine for linking to the control point. The quarter-wavelength matching section at the bottom is 3/4-wavelength at 446 MHz, so it has the same transformer characteristics. (Such matching sections may be any odd multiple of a 1/4-wavelength.)

I have used this J design on 2 meters for several years. The J is an excellent antenna for public service and emergency work because it does not require a ground plane. I mounted it on a 1/2" thick plastic base, 8" x 8". Wood works fine for the base, too. You can set it just about anywhere (preferably high and in the clear), hook up the coax, and be on the air in seconds.

Figure 1 shows the dimensions. The elements are 1/8" diameter stainless

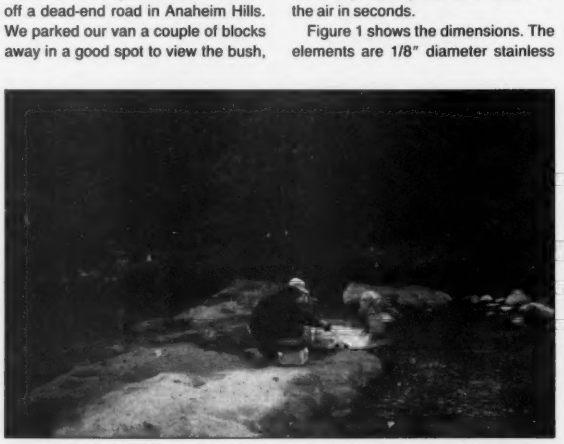

Photo B. When Milt Ronney WA6FAT hides the T, you never know what to expect. This time, he is testing the "river effect" on VHF propagation by setting up in the middle of Santiago Creek.

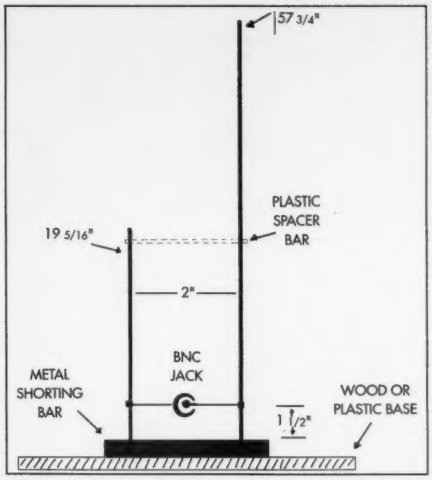

Figure 1. This easy-to-build 2 meter J antenna also works on 70 centimeters. See the text for element information.

steel welding rods. Stainless elements are strong, flexible, and non-corrosive, but attaching them at the bottom is a problem. You may prefer to use brass or bronze rod if you are not equipped to solder stainless steel or to drill/tap the shorting bar to accept the rods.

The shorting bar at the bottom is mandatory, but do not connect the bar to the rig's ground. For this hunt, I covered the elements with black electrical tape to make the antenna invisible in the bushes under the street lamps.

Center the coax connector between the elements. I prefer a BNC receptacle instead of the usual SO-239. Clamp the wire leads from the connector to the elements at the points shown. You may need to slide the connector assembly up or down to achieve the best SWR, but both leads should end up at the same distance from the bottom shorting bar.

The plastic spacer is important to keep the matching section elements parallel, two inches apart, at all times. I held my spacer in place with hot glue, but you could drill and tap the plastic for setscrews.

My handheld is happy with 2:1 SWR, which was easy to achieve on both bands. With a little pruning and tweaking, you should be able to get 1.5:1 or better at your hunt frequency.

A Store-Bought Alternative

If you would rather buy a J than build one, consider the new Pocket Roll-Up J from MFJ Enterprises, Inc., P.O. Box 494, Mississippi State MS 39762; (601) 323-5869. The MFJ-1730 (see Photo C) uses TV-type twin-lead for the matching section and radiator. It features a ferrite choke balun to keep RF off the coax shield and improve the match. A 4-1/2' RG-58 pigtail with BNC connector goes to your handheld.

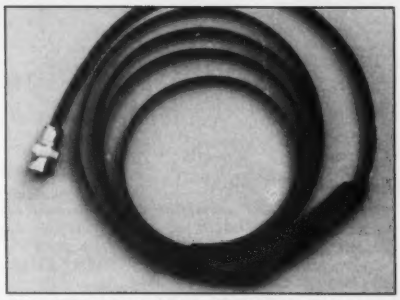

Photo C. The MFJ-1730 Pocket Roll-Up 2 meter J antenna is easy to carry to the hiding site. The bulge is the ferrite choke balun.

While it won't stand alone on a table like the antenna of Figure 1, the Pocket Roll-Up is much easier to transport. It is ideal for hanging from a tree or bush. It will support its own weight, but I would not recommend using it to hold up the rig, particularly if you use an oversize battery. The internal solder connections may not withstand that much strain. Support the transceiver underneath, use the belt clip, or suspend the rig with a separate piece of nylon line.

In my tests, the J of Figure 1 and the Pocket Roll-Up gave equal performance on both 2 meters and 70 centimeters. Range was much greater than a quarter-wave whip in each case. My wattmeter measured 1.3:1 SWR on the MFJ-1730 at the 146.565 MHz Southern California T-hunt frequency, rising to 1.8:1 at 148 MHz and 2.4:1 at 144 MHz. Lowest SWR on 70 centimeters was 1.2:1 at the high end of the band, rising to 2.3:1 at 440 MHz.

Even on an intermittent-signal T-hunt, the transmit duty cycle is higher than in a casual QSO. So give your HT some extra cooling help. I removed the belt clip and bolted a 3" finned heatsink in its place for the RACES hunt. That was sufficient for a 5 watt HT on a cool evening, but you may need a small 12 volt fan on a hot day. Happy hiding! 73

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Wisconsin ATV Flight

On December 7, 1991, a group from Hillsboro, Wisconsin, launched an ATV balloon with some interesting innovations. I think you'll find some of these ideas of value for your ham shack or repeater installation.

The Package

Based on the successful flight and recovery of their previous voice repeater flight, Joe Mayenschein WB9SBD and Tim Tomljanovich K9SB decided to risk a full video package on this mission. The ATV section consisted of a PC Electronics KPA5-RC 1-watt ATV transmitter (439.25 MHz) with an FMA5 audio subcarrier board, a miniature B/W TV camera (similar to the one offered by both GBC Corporation and Micro Video Products), a Uniden Bearcat 100XLT scanner and a 10 meter AM transmitter on 28.322 MHz (see the April '92 issue of *Radio Fun*, p. 18) with voice ID (see the November '91 issue of *73*, p. 11). The antenna system consisted of an Olde Antenna Labs Mini-Wheel for ATV, a dipole for 10 meters and a ¼-wave whip for VHF.

In addition to the live ATV camera transmissions, they programmed the scanner to receive on two channels on 2m FM. One frequency was the "free-for-all" uplink and the other was a priority channel for control of the mirror system and to make announcements from mission control.

Anything heard on the 2m uplink was repeated down via the ATV audio subcarrier as well as the 10 meter AM transmitter. In essence, this would be a super-wide coverage crossband repeater!

Remote Camera Pointing

Joe WB9SBD came up with a very inexpensive and effective method of remote camera pointing. Rather than move the entire camera around with servos, Joe mounted a motor-driven first-surface mirror in front of the TV camera at a 45° angle. The first surface mirror (cat. #2741) is available from American Science Center; (708) 475–8440. Edmund Scientific is another good source of first surface mirrors.

With two angled pieces of PC board material, Joe was able to suspend the motor/mirror assembly at just the right point above the camera. Viewed on edge, the two pieces of PC board in the field of view of the camera are hardly noticeable (see Figure 2).

The motor-driven mirror rotated at 0.5 rpm, giving them a continuous 360° pan of the camera view every 2 minutes. The motor (12 VDC at 0.5 rpm) is made by Hankscraft and only draws 4 milliamps when operating. You can contact Hankscraft at (608) 524–4343; a variety of operating voltages and rotation speeds are available. If you plan to send one up in a balloon, be sure to specify a greaseless motor to handle the −60° temperatures in the upper altitudes.

Joe and Tim added a Norcon touch-tone controller (model TD16 with 16A expansion module) which allowed them to turn the motor on or off by remote control. To change the camera view, they just activated the motor via a touch-tone sequence and waited for the mirror to rotate to the desired point. Keep in mind, however, that the image as viewed through the mirror will be reversed. Some TV cameras have a reverse scan switch which allows you to compensate for this effect.

To identify their balloon ATV transmission, they mounted a thin strip alongside the edge of the package with their reverse image callsigns. Since the camera focuses from 6" to infinity, this method of video ID worked very well during the flight.

Photo B. Inside view of the payload showing the 10 meter AM transmitter and voice ID circuitry.

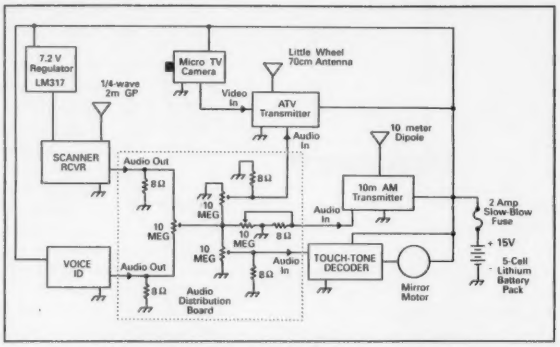

Figure 1. Schematic diagram of the balloon payload.

The Flight

After a late night session of final construction and testing, the launch team assembled near Joe WB9SBD's farm around 7:30 a.m.. After various Murphyisms (the N-connector on the receive antenna fell off, the regulator on the helium tank wouldn't fit and there was intermittent video from the payload), everything somehow came together.

At 9:45 a.m., the HBT-2 (Hillsboro Balloon Team) mission took off under near ideal ground conditions. Since a storm front had cleared out of the area a few hours earlier, visibility was excellent. Everyone watching the ATV downlink at the launch site was treated to spectacular views of the rolling Wisconsin farmland. The remote mirror system worked great. The touch-tone system worked perfectly, allowing the control station to easily point the camera view at the horizon, at the ground below or even up at the balloon itself.

Reports came rolling in via the HF net on 7.155 MHz (Scott ND9C was the net control). Just 10 minutes after takeoff, Mike WBØQCD reported seeing P4 pictures from Iowa. Soon afterwards, reports of nearly snow-free video reception came in from Ron W9ZIH in northern Illinois and Andy N9AB and others in the Chicago area. One station even reported seeing P2 level pictures in Arkansas! Apparently there was some interesting ducting going on during the flight.

Both the ATV audio subcarrier and the 10 meter AM downlinks from the crossband voice repeater system worked quite well. It was fascinating to hear distant stations describing their video reception on the 2 meter talk frequency.

Treed

Although the ground wind conditions were great, the upper level winds were another story. Since the jet stream winds were over 100 knots, it was decided to use a much smaller balloon to shorten the total distance traveled. This resulted in a short flight that made it just to 45,000 feet before the balloon burst. However, since the small bal-

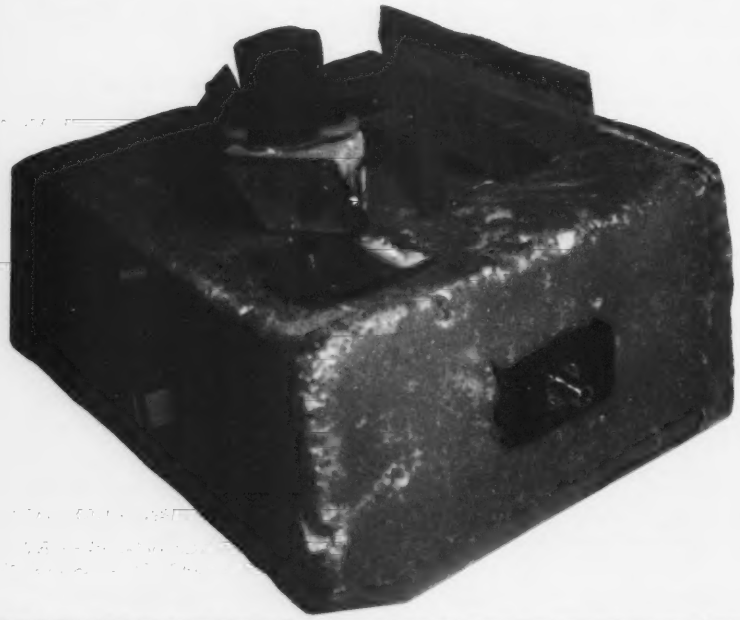

Photo A. The completed payload showing the unique rotating mirror system. The motor turned a mirror (slanted 45°) in front of the TV camera which provided a continuous 360° view every two minutes. The callsigns are reversed so they appear normal in the downlinked video as seen through the mirror.

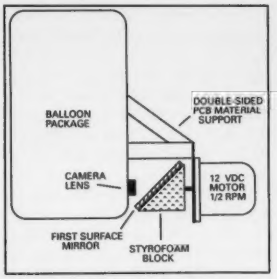

Figure 2. Details of the mirror mount.

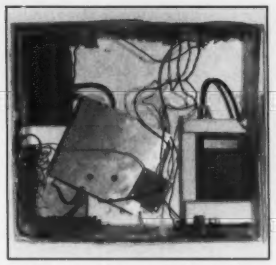

Photo C. Inside view of the styrofoam package showing the Uniden Bearcat scanner (upper left), ATV transmitter (center, in shielded case), back of TV camera (lower right), voltage regulator (upper right), touch-tone decoder (lower right), lithium batteries (lower left) and the 10 meter AM transmitter (upper left).

loon covered more than 60 miles in the 45 minute ascent (average ground speed of 80 mph), the large balloon capable of reaching 100,000 feet in altitude would've dropped the payload some 160 miles downrange (right in the middle of Lake Michigan!).

Since the balloon burst somewhat sooner than expected, most members of the chase team were too far downrange. Through triangulation of beam headings and by watching for landmarks on the video signal (a large lake helped), the location of the landing site was narrowed down to an area just 10 miles east of Portage, Wisconsin. It was found 15 minutes after touchdown, dangling 40 feet up in a tree near the town of Rio (on the property of the Chief of Police). One brave soul scaled the dry, frozen, and relatively branchless tree and safely brought the package (and himself) back to the ground in perfect shape.

Joe WB9SBD, Tim K9SB and the Hillsboro group plan a number of future flights with a variety of intriguing payloads. If you'd like to find out about amateur radio balloon payloads, Joe has started a BCAR (Balloon Carrying Amateur Radio) net on 14.255 MHz every Saturday afternoon at 3 p.m. Central time. Also check out the "Balloon" area on the *73* phone-line BBS for the latest information. 73

Photo D. (l to r): Tim K9SB, Stuart WB9UNX, chase dogs (Blackie and Teddy), Joe WB9SBD and Brian KA9QJT prepare to launch the balloon.

Photo E. The recovery team after retrieving their prize from the tree. (l to r): James N9LKY, Jim N9KAN (behind James), Steve WB9ZRE, David KE9KX, Lennart KB9GDY, Brent Hughes and Tim K9SB.

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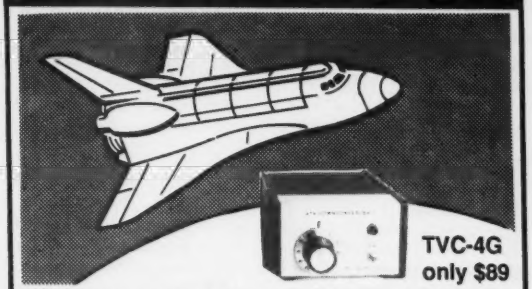

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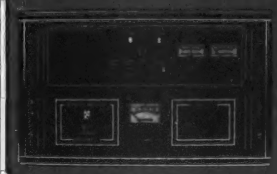

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Miami Tropical Hamboree

Attending the Tropical Hamboree in Miami has always been a terrific experience for me. This February, however, those hams and non-hams alike who came to assess the role of youngsters in the hobby were in for a real treat. Under the extremely capable guidance of Evelyn Gauzens W4WYR, who is the General Chairperson of the event sponsored by the Dade Radio Club, Inc., hundreds of free passes were distributed to local schools for children to be able to attend at no cost. The tremendous efforts and hard work of Evelyn and the club really paid off. Not only was the Hamboree a huge success, but the Youth Forum which I had the privilege of moderating was well attended by children. Many parents came to the forum, too, but more importantly, the young people showed up to hear what their own peers had to say about amateur radio.

As a teacher who deals with hundreds of children a year in my own school, I certainly appreciate and applaud the efforts of the manufacturers to encourage youngsters to get involved with amateur radio. We should all support the manufacturers who support the educational forums and programs across the country. The main prize to be awarded to a young person in attendance was a Kenwood R2000 wideband receiver. I wish everyone could have seen the look on the face of the little boy who won it. It was wonderful! ICOM, Yaesu, and the ARRL also contributed door prizes, much to the children's delight. The dedicated folks at MFJ and Heath have always been very supportive of my educational efforts with amateur radio. Special thanks must go to Rosalie White WA1STO, educational coordinator of the ARRL, who was a big help with the publicity and gathering of prizes for the Youth Forum. Rosalie also moderated the Instructor's Workshop that weekend.

The Youth Forum

Well, I certainly had an outstanding group of children to work with in Miami. What a joy to have articulate, enthusiastic young people volunteer to speak to a packed room of children and adults about their love of amateur radio. These youngsters are the future leaders of our hobby, and I'm so delighted to have been able to showcase them at the Hamboree.

Lee's involvement in amateur radio was largely responsible for the self confidence and ease that we in the audience could easily see he possessed.

MY next speaker is no stranger to making public appearances. Sammy Garrett AA0CR, age 14, is the winner of the Westlink 1991 Young Ham of The Year award. I've had the pleasure of working with Sammy before. He was a guest speaker at my Youth Forum in Dayton in 1991 and did a terrific job there also. In his talk, Sammy stressed that you don't have to be a nerd or a great brain to get involved with the hobby. He said that any kid who really wants to get into ham radio and have fun with it has a good chance to do it. He also cautioned the young people to not let it consume their lives to the exclusion of other important young people's activities.

"What a joy to have articulate, enthusiastic young people volunteer to speak to a packed room of children and adults about their love of amateur radio."

Chris Hadden N0GXB was the first to speak. Chris is the 1991 recipient of the ARRL Paul and Helen Grauer $500 Scholarship. Chris is a computer science major at the University of Nebraska. He is actively involved in many different modes of radio communications and provided an excellent role model for the youngsters in attendance.

Next at the microphone was the very eloquent Lee Cicreszko N4TCW, 18 years old. Lee made quite an appearance dressed in his Police Explorers uniform. He was busy the whole weekend helping out with communications at the Hamboree. Lee explained his love of public service, working with the Sheriff's office and helping out at local public activities. He also was very adept at answering questions from our young audience about UHF, VHF and radio wave propagation. I'm sure that

Mike Abbattista KD4CQT is 13 years old and in the 8th grade. He is a student of Phyllisan West KA4FZI, who has a wonderful ham radio program that encourages less advantaged children to get involved with technical studies at Caloosa Middle School in Cape Coral, Florida. Mike showed us a simple, easily assembled telegraph key made by youngsters in his class. Mike is also an active member of the Ft. Myers Radio Relay League.

Everyone at the forum was totally captivated by Louis Zuckerman KD4HRD, who is a bright, vociferous 8-year-old. Louis got his license in December 1991, much to the delight of his fellow 3rd graders. Both mom and dad are very active in the Dade Radio Club of Miami. After meeting with this enthusiastic ham family in Miami, it was obvious to me that Louis is going to have many fabulous, fun years ahead of him in ham radio with his folks. Louis told the group assembled that he especially loves talking to radio operators in foreign countries. He's already had a terrific QSO with someone in Japan named Hida JF1SEK on the day of President Bush's visit there. What an inspiration this youngster can be for other children!

Torben Bush KC4ZNI is 16 years old and attending Coral Gables High School. He told us how he attended the evening amateur radio class taught by Harry Pilafian W4SQG, along with his dad. Torben helped form the Dade Young Amateurs Association. This group was formed so that youngsters could have their own organization under the supervision of adults. He is also a member of the South Florida FM Association and the ARRL.

Derek Urwin KD4DIF is presently in the 7th grade at Arvida Middle School and has his General license. Derek was in Audrey Pilafian KB4ZQU's gifted 6th grade class last year. He got interested in ham radio when Harry Pilafian taught several classes there. Both he and his father attended Harry's licensing classes in the evening. He too is a member of the South Florida FM Association and the Dade Young Amateurs Association. Let's never underestimate the influence that a teacher can have by exposing youngsters to interesting, stimulating, and exciting demonstrations.

Paul Kunicki KC4YWK is 14 years old and has a Technician license. Paul spoke eloquently about his move from CB to ham radio. His father is a ham radio operator also. He is an active member of the Dade Radio Club of Miami and maintains the club station, W4NVU.

Every one of these young presenters made a profound case for the advantage to all of us in recruiting bright, motivated boys and girls into ham radio. Please be on the lookout for articulate and enthusiastic youngsters who would like to join me in participating in other youth forums. Have them get in touch with me; it's a marvelous experience for a young person. 73

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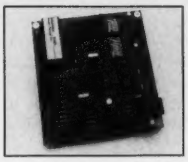

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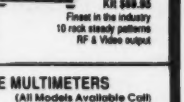

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Never Say Die

Continued from page 4

board displays in New Hampshire hotels and motels selling film and offering processing.

Everyone visiting New Hampshire brings a camera or two, so why not put the film right out there where it's easy to buy and give the motel a commission on the sale? And get them to get their guests to send in the exposed rolls for processing for another commission. The finished pictures can be mailed to their home address. He'd soon have a fairly large business going and be able to expand into Vermont and Maine, both good vacation states.

I don't know if he has the drive to try and start a business, but there's one just waiting for someone to make it happen. That could build into a multi-million-dollar business in two or three years.

There are unlimited new business possibilities if people would only start thinking in those terms.

We have many products which could be developed for foreign sales. I don't know if you're aware of it or not, but America is one of the largest exporters in the world. Our exports have been growing recently and are now within $17 billion of our imports. Quite a turnaround.

The recent growth of new licenses as a result of the no-code Tech license has gotten a rash of new small businesses going in the ham market. Our new ham population has doubled in the last year...which is why *Radio Fun* has been doing so well. It reaches these newcomers and gives them the information they enjoy reading. I'm delighted at some of the testimonials I've been seeing from advertisers too. The ham market is beginning to show some life. Too bad if you're not getting *Radio Fun*!

More Unreasonableness

You've been reading about the mess our American educational system is in and the desperate need for restructuring. You've read about how our students are among the worst in the developed world in math, science, geography and so on. Of course we make up for this incredible lack of results by spending more than double what most countries do per student.

One result of this disaster is that we have such a poorly educated work force that we're no longer competitive with other countries with better education systems.

Yes, I know I should be busy working DX on 20m and shouting curses at KV4FZ, but I can't seem to help myself from getting embroiled in this education mess. You see, I have this fanatic religious conviction that amateur radio is a key to helping fix this whole thing. I know my vision is not shared by many hams and is abhorred by the ARRL. The last thing the old-timers running the League want is a zillion kids lousing up their bands.

So my quest to get an eight-year course in the fundamentals of electronics, communications and computers into every school in America, backed up with radio, computer, science fair, and electronic experimenter clubs, is just another of my windmill jousts... like my campaign for the no-code license.

My vision is of two million American hams...no, make that three million...shouldn't we at least have double the number of hams in Japan, where they have half our population? And I see our newcomers going back to 80% youngsters as it was in the 1950s. Further, I see amateur radio again becoming visible to the general public and performing a service worthy of the frequencies we have allocated. I see our main service to America as a supplier of enthusiastic high-tech career youngsters who will help build tens of thousands of small high-tech companies.

Poor old dreamy Wayne...the clean air up there in New Hampshire must have gone to his head. Maybe. But it hasn't stopped me from getting involved with the New Hampshire Economic Development Commission Education Subcommittee and with the New Hampshire High Tech Council Education Subcommittee. Nor has it stopped me from reading everything I can find about restructuring our educational system or attending workshops on the subject.

The result is that I have a fair idea of what's gone wrong and, as usual, some creative ideas on how to improve things. If you're interested in my reports to the governor, the Economic Development Commission, and so forth, you can get a dump of my writings via the *73* BBS. Or you can send $2 to cover duplication and mailing to Professor Green, 70 Route 202 North, Peterborough NH 03458.

For that matter, I'm working on a book form of my complete report to the Commission. I hope to have it available in May. $20 should cover the cost... hey, it's going to run close to 300 pages. That sounds like a lot of money, but a ham in Alaska got a copy from our BBS and has already started some of the creative new businesses I outline in the report.

Reinventing Schools

How radical are my educational ideas? In addition to the tech course and high-tech clubs, I'm recommending that schools go to 50 weeks a year with 10 five-week terms. That leaves a week off at Christmas and another in July.

It gets worse. I'm also recommending that we end compulsory education in New Hampshire...that we allow students to progress at their own speed instead of in factory lock step...that students be allowed to take five week vacations when they want, taking off for a term now and then. No grades. No exams. Students work in teams of four instead of singly. The pass-fail decisions will be made by one's fellow students, not the teacher. No more "teachers" either; now they'll be facilitators and team leaders.

Well, you'll have to read my papers on the subject to understand the reasoning behind all this and how it all fits together as a completely new educational system. Much of the responsibility for one's education will rest on the students and their parents. I've also suggested ways of getting parents far more involved with the whole process.

Isn't that what freedom is all about? Why should all children be sentenced to 10 years of involuntary servitude in government institutions? We call that slavery when it's adults. Isn't it time we slowed down on doing things for people's own good and started using reason and rewards to encourage compliance?

At 70 I don't know if I'll live long enough to see either the rebirth of amateur radio or its death...but I know one or the other can't be far ahead, with no middle ground visible. You can check back over 42 years of my editorials to see how accurate my visions are. After reading a few old issues of *73* do you really want to bet I'm wrong? How much?

I suppose I should do like 90% of our retired hams and devote the rest of my life to rag-chewing and golf instead of getting all het up about education and helping New Hampshire out of the recession with a long list of proposed strategic initiatives.

None of my initiatives are really peculiar to New Hampshire. Many would help other states to cut down on state expenses, cut taxes, help industry to grow, and re-invent education. I don't want to suggest for a minute that you cut down on your rag-chewing, golfing or watching football on TV. I know that 99.9% of you won't have the drive to try to actually *do* anything, but I kind of hoped a few of you might at least be interested enough to read what I've written and write to tell me that you don't agree with everything I propose...naturally omitting any details on what you don't agree with or why.

And you're right. It's the nail that sticks up that gets pounded down, so never make any waves. But you know, I've spent most of my 70 years being pounded down. *CQ* has dumped on me. *QST* has dumped on me. The IRS dumped on me. An ex-wife dumped on me. Newspaper and magazine articles have dumped on me. I've got tapes of ARRL officials dumping on me at ham conventions. Yet for some reason I keep making waves. Crazy old coot, must be the answer. You'll be a lot safer if you don't send for my stuff.

No Russian Trip For Wayne

I've been hoping I could get to Russia in May with Dave Larsen KK4WW. Outside of the fun of operating from Russia and the Ukraine, I was hoping my expertise in small business development might be helpful. One of their biggest problems is converting from a government-run society to private businesses. I don't know if I could help or not, but it seemed worth trying.

But then as my Economic Development Commission work dragged on months longer than I imagined possible, I had to finally admit that I just wasn't going to be able to get away.

In addition to my Commission work and a serious battle with the six major record companies to keep them from getting a tax put on all digital recording media (which they would split), I'm also starting a new music publication, the *Secret Guide to Free Music*. Plus I'm building up our recording, distribution and mail order businesses. The recession has hit the music industry too, so that means more work for a while.

Perhaps by 1993 I'll have things more in hand and be able to get away. Perhaps by then the Russian countries will be settled down a bit and be better able to use my guidance. Things are probably in such a turmoil right now that I wouldn't be of much help. I think that only Moscow has really started encouraging small businesses to be formed.

Still, I sure enjoy working the pile-ups. I love whittling 'em down, right on down to the mobiles and QRP ops. Doing the QSLs isn't as much fun.

I had another DXpedition offer to Sakhalin Island...you know, where they shot down the Korean airliner. I just don't have the time...sigh. Now why didn't I retire like everyone else when I was 65? 73

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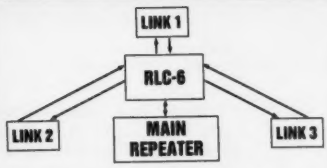

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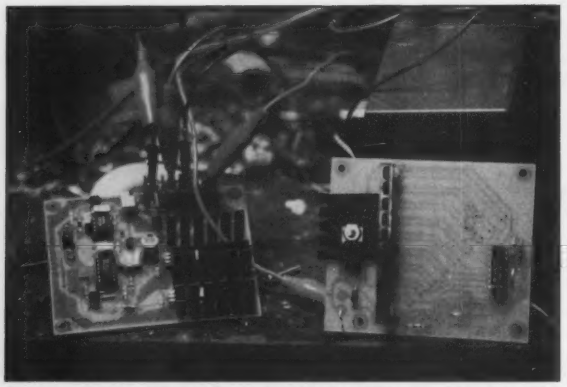

Photo A. Monitor your DC supply with this LED expanded voltmeter circuit (shown on the right).

Michael Bryce WB8VGE
2225 Mayflower NW
Massillon OH 44646

LED Expanded Voltmeter

Can you stand just one more expanded voltmeter? I sure hope so, as this is an easy project to put together and operate. In fact, there is not one single adjustment to be made. What makes this expanded voltmeter special is the 10-segment LED readout. All this magic is carried out by an LM3914 dot/bar display driver IC.

Unlike other chips used today, the LM3914 does only one thing, and that is to light up 10 LEDs in bar mode, or one of 10 LEDs in the dot mode, in response to an input voltage. The LM3914 contains a voltage divider and 10 comparators that turn on in sequence as the input voltage rises. There's also a 1.2 volt reference voltage source inside the LM3914. The LM3914 comes in an 18-pin dual in-line package. Figure 1 contains a simplified version of the circuit of the LM3914. You could build your own version of the LM3914 using LM339 comparators to get a 10-LED bar display, but I don't see any reason why. The LM3914 goes for about $3 at most electronic supply houses.

How It Works

The expanded voltmeter takes advantage of the external reference pins of the LM3914. You can use either the built-in 1.2 volt reference or supply a reference voltage to pin #6 (Rhi) of the LM3914. Pin #4 (Rlow) is the ground return for the divider chain. This is exactly what we're going to do when we build the voltmeter.

The reference voltage we'll feed to the LM3914 comes from a 7805 1-amp regulator. This regulator will also source the LEDs. The +5 volts is placed on pin #6 of the LM3914. The low end of the divider chain is pin 4 and it's grounded. Pin 6 is +5 volts, pin 4 is ground, so we have established 5 volts across the divider. The LM3914 then divides this 5 volts into 10 equal steps, each one 0.5 volts DC. This establishes the full-scale voltage (0–5) of the meter.

The battery voltage is fed to a zener diode. In this case, it's a 1N5240, a 10 volt zener diode. This zener diode subtracts 10 volts from our incoming voltage feed from the battery. The 390 ohm resistor connected in series to the zener diode continually draws current through the zener diode and makes the voltage drop stable. The value of this resistor is not critical. You can use almost any value from 220 ohms up to 1,000 ohms. Use something close if you don't have the 390 ohm resistor in the junk box.

If we use a 12 volt battery, the LM3914 "sees" only 2 volts. The 2 volts are then applied to the input of the LM3914 and, when compared to the 5 volt reference, the chip will then light up four LEDs (in the bar mode). Remember, each LED is worth 0.5 volts, so 2 volts equal four LEDs. By using the zener diode, we have expanded the range of the meter to read 10 volts, no LED on, to 15 volts, or all LEDs illuminated.

The 1.5k resistor on pin #7 of the LM3914 is used to control the amount of current flowing though the LEDs. Since we're feeding the LEDs' anodes from the 7805, we can adjust the value of the 1.5k resistor to suite your liking. Lower the value and the LEDs will get brighter; raise the value and they'll be dimmer. The brighter the LEDs, the more current we'll be demanding from the battery we're trying to measure. If you don't happen to have a 1.5k resistor in your junk box, a 2.2k works very well.

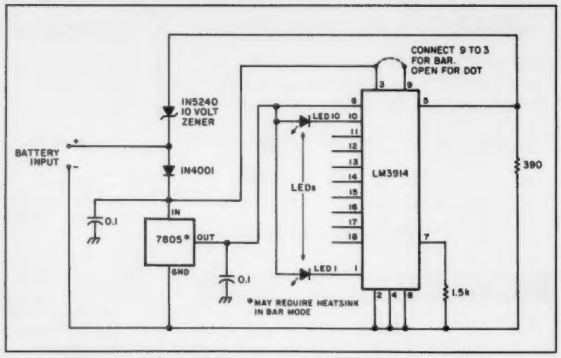

Figure 1. Schematic diagram of the expanded voltmeter.

We could have sourced the LEDs directly from the Vcc line, but that would have really put stress on the LM3914. They're kind of expensive chips to be cooking, so stick with the 7805.

To keep the electronic expanded voltmeter from going up in smoke if you connect it to the battery backwards, a simple 1N4001 diode is used. If you hook the meter up backward nothing bad will happen; in fact, nothing will happen at all.

Another feature of the LM3914 and of this project is the ability of the LM3914 to display either a moving dot (one LED at a time) or bar mode (many LEDs at one time). Pin 9 selects either one. When pin 9 is connected to Vcc, we have bar mode. If pin 9 is left floating, dot mode. We should connect pin 9 to pin 11 when using dot mode, but I have not had any trouble just leaving the pin float.

Construction Tips

Because of the number of components used, a small piece of perfboard could be used for construction. However, a lot of mistakes can be made when connecting the LEDs to the LM3914. A ready-made PC board is available from Far Circuits, 18N640 Field Court, Dundee, IL 60118, for $8 plus $1.50 for shipping. A complete set of parts, including the PC board, LM3914, LED strip and the 7805 may be purchased for $19.95 plus $1.50 shipping from me.

Watch the Vcc and ground pins as they are different from many ICs you may be used to using. The Vcc pin is #3 and the ground pin is #2. Remember, the LM3914 comes in an 18-pin DIP package. As the LM3914 is kind of expensive, it would be a good idea to get a socket for it.

The PC board has been laid out to accept a 10-LED strip. This makes a really nice display as all the LEDs are straight and of equal intensity. This strip is available from Mouser Electronics (part number is 351-2011). Of course, you don't have to use the LED strip as regular LEDs may be used. If you go this route, check each LED for brightness before you solder it in the PC board. I mounted the LED strip by inserting a 0.625" long nylon spacer on

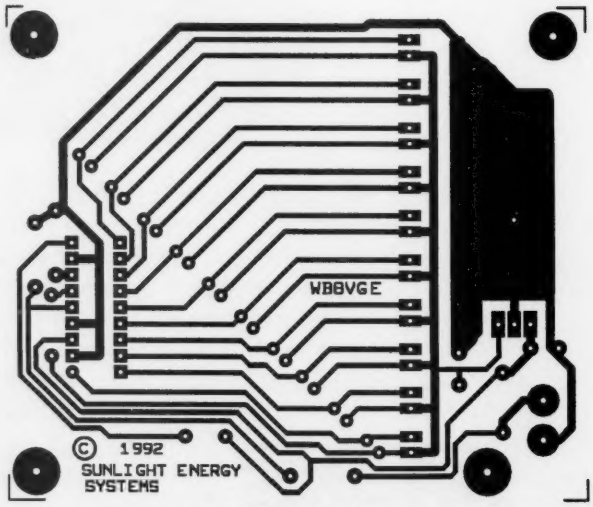

Figure 2. PC board foil pattern.

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CIRCLE 121 ON READER SERVICE CARD

the first and last LED. This provides support and keeps the LED strip from bending. If you don't use the LED strip, you could use nylon spacers on each LED as well to keep them all upright. It might be a tight fit with all 10 spacers under the LEDs.

If you use individual LEDs, you might want to add some color to the project. The lower voltage LED could be red, some yellow or green in the middle, and red LEDs at the top two positions.

The PC board allows you to install the LEDs either vertically or on a slant. Don't install two rows of LEDs! Doing so will french fry the LM3914.

Install a small heat sink to the 7805 regulator if you use the voltmeter in the moving bar mode. You won't need to heat-sink the regulator if you set the mode to moving dot as only one LED will be on at a time.

Assembly is easy. Stuff the PC board and check out your work. If you want the moving bar display, solder a resistor lead in the two PC holes marked "mode." For the moving dot display, don't use the jumper.

Check over your work before adding juice to the circuit. There's nothing to adjust or set up. Use a variable power supply to test out the voltmeter to verify operation before you connect the meter to a battery. As you raise the voltage, the LEDs will light up (depending on what mode you have the display in). If you have the display in the moving bar mode, at 15 VDC all the LEDs should be illuminate. At 10.5 volts, all the LEDs should be dark.

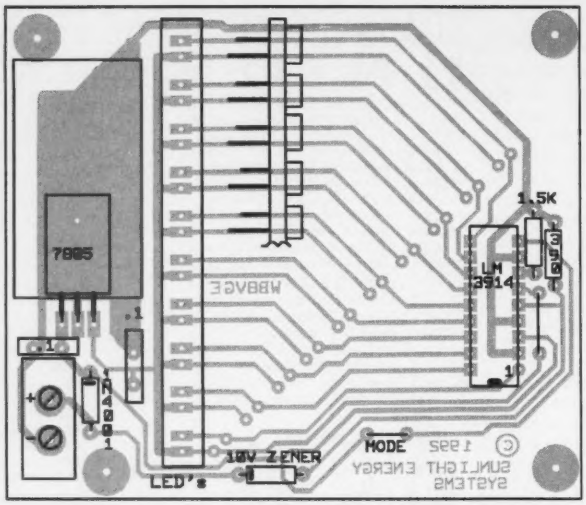

Figure 3. Parts placement.

That's it! But before you button the meter up, you'll have to add some type of scale. I for one can't remember what LED should be glowing at any one time.

Install the meter in a small plastic box. A paper scale was laid out and placed on the front of the box. This method seems to work quite well. Nothing fancy, but it gets the idea across. Start with the bottom LED at 10.5 volts (at 10 volts, all the LEDs are off) and the top (or tenth LED) at 15.5 volts.

If you have the display set as a moving bar, total current for all the meter will be around 130 mA. Moving dot display requires 30 mA. In the moving bar mode, I would not want to leave the meter connected to a small battery very long. This expanded voltmeter would be a great accessory to a variable power supply on your work bench. RVers, as well as mobile operators, might find it useful.

Field Day QRPers can keep an eye on their batteries. You'll find this expanded voltmeter a valuable part of your tool box.

Number 19 on your Feedback card

CIRCUITS

Great Ideas From Our Readers

Crystal Matching and Activity Tester

Hams still use crystals for many purposes: VXOs in QRP gear; in matched frequency sets for IF ladder and lattice filters; local oscillator injection to product detectors; as "quick and dirty" RF sources for experimentation, and many other uses. Many different crystals available as surplus are quite inexpensive, and there are a number of crystals residing near the bottom of a number of junk boxes, many of which can be put to use.

Crystals vary in activity and many crystals, especially those in FT-241 and FT-243 holders, tend to age, and both frequency and activity are subject to change over time. Even if they have quit entirely they can be taken apart and washed in alcohol and replaced in their holders. Modern crystals in hermetically sealed metal cases seldom age much and rarely quit operating unless a mechanical shock has broken an internal connection.

This simple circuit allows rapid testing of crystal activity—if the crystal is good, the LED lights. The connector allows monitoring of crystal frequency with a frequency counter, making selection of matched frequency crystals for IF filters a simple matter. Crystals of frequencies from below 1 MHz to over 13 MHz will oscillate readily in this circuit. Crystals oscillate in their series mode, slightly higher in frequency than that marked on the holders.

One-half of a 7400 2-input quad NAND gate TTL chip is connected as an oscillator and is followed by an NPN transistor switch. RF from the oscillator is rectified by a pair of germanium diodes (silicon will also work), filtered, and the resulting DC voltage applied to the gate of the transistor, which causes it to conduct. Collector current then illuminates the LED to indicate that the crystal is oscillating.

A crystal of normal activity will cause the LED to light brightly. If crystal activity is low the LED will be less bright, and the crystal most likely should not be used. If a crystal will not oscillate, the LED will remain dark.

If a very accurate indication of crystal activity is required, the diodes and filter can be fed through a potentiometer into a microammeter to ground. This replaces the transistor switch and LED. The pot will set the meter indication at a reference point on the meter scale with an active crystal in the circuit. Additional crystals will produce a meter indication higher or lower than that established with the first crystal, thus showing they are more or less active oscillators. This is rarely of major importance. The simple GO-NO GO indication with the LED will suffice in most instances.

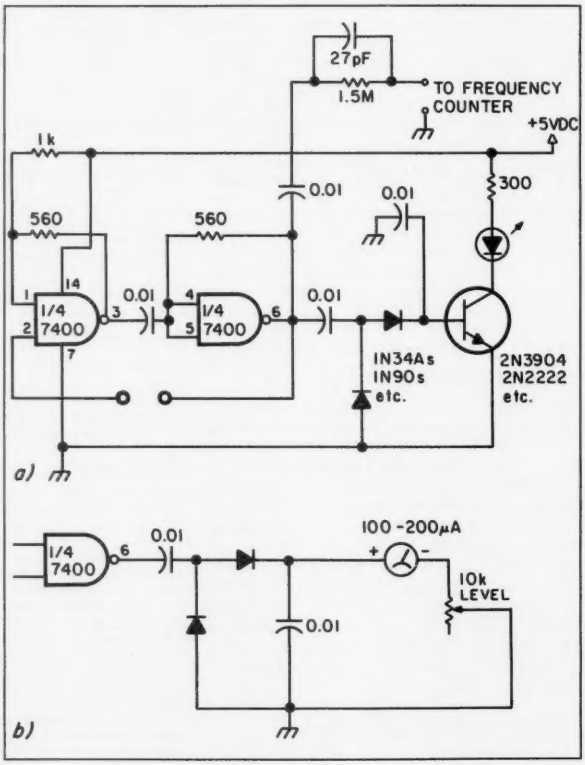

Figure 1a and 1b.

Depending on the type of holders used for the crystals you have, one or more suitable crystal sockets can be paralled for ease of use in testing.

J. Frank Brumbaugh KB4ZGC
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RTTY Loop

Continued from page 78

dialects of BASIC, from older interpreted ones to some of the compiled versions of the language now available.

As you can see, I aim to please, with responses to your questions! Next month, we'll try to get through a stack of letters that are gathering dust on my desk. In the meantime, feel free to bug me by mail, on CompuServe (ppn 75036,2501), Delphi (MarcWA3AJR), or America Online (MarcWA3AJR). I look forward to each and every comment or question, critique or suggestion, about "RTTY Loop." 73

(Program listing continued from page 78)

```
1140 IF WPM>=13 THEN ELE=DIT ELSE ELE=DIT*((CWPM/WPM-
     1)*13+2)/2
1150 RETURN
1160 '
1170 ' display current speed and frequency. return cursor where it was.
1180 COL=POS(0): ROW=CSRLIN: LOCATE 1,60
1190 PRINT " wpm: "; WPM: LOCATE 2,60: PRINT "freq: "; F; "  "
1200 LOCATE 2,5: PRINT WPM; "  "
1210 LOCATE ROW,COL
1220 RETURN
1230 '
1240 ' set MORSE to random value from 0 up to numcodes to select random
     char.
1250 ' force a space character after every fifth time we are called
1260 ' and a newline before every 13 groups.
1270 IF NCHRS=5 THEN PRINT "  ";: GOSUB 990: NCHRS=0:
     NGRPS=NGRPS+1
1280 IF NCHRS=0 AND NGRPS=13 THEN PRINT: NGRPS=0
1290 MORSE = INT(RND*NUMCODES)
1300 NCHRS=NCHRS+1: RETURN
1310 '
1320 ' handle F9, the pause control.
1330 COL9=POS(0): ROW9=CSRLIN
1340 LOCATE 24,30: COLOR 16,7: PRINT " Press any key to continue ";
1350 X$=INKEY$: IF X$="" THEN 1350
1360 LOCATE 24,30: COLOR 2,0: PRINT "                    ";
1370 LOCATE ROW9,COL9: RETURN
```


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MRF141G	190.00	2N5179	1.25	M57732L	34.70	813 PL	36.95
MRF151G	179.95	2N5589	13.00	M57737	38.95	833A PL	84.95
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MRF239	17.00	2N6080	9.75	M57796	35.70	6146B NAT	13.95
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MRF476	4.00	2SC2075	1.75	6GK6	13.95	Match Pr.	45.90
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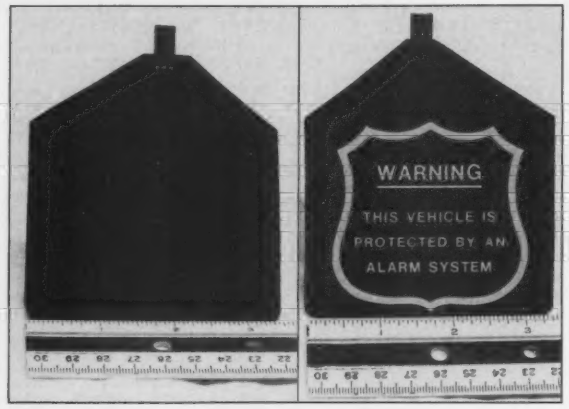


j•COM

New from j•Com is a series of almost invisible antennas for VHF and UHF. The Stealth Antenna is a tiny 3.5" square of 0.003" thick copper-clad polymide coated with a non-corrosive graphite colored coating which adheres to the inside of a car windshield. It looks so much like a decal that it is even available with an optional printed warning symbol to deter would-be thieves and vandals. Thieves in search of a an expensive transceiver to steal are less likely to be attracted to a vehicle that doesn't have a visible antenna.

Despite its incredibly small size, this antenna outperforms a quarter-wave whip under many circumstances. It is an etched copper antenna, multipolarized to reduce QSB caused by the varying polarization of signals received in a moving vehicle. The antenna presents a low SWR over the entire band and requires no adjustments or tuning. Best of all, it can be installed without drilling holes or risking paint scratches from magnets or suction cups. Once installed, it is inside the vehicle, protected from the elements, and never in the way in a car wash or low garage.

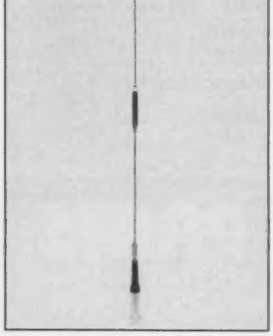
The Stealth Antenna is available in models for 146 MHz, 220 MHz, and 440 MHz. The standard model can handle 50 watts of input power and costs $59.95, including shipping in the continental US. A high power version capable of handling 110 watts is available for $69.95. Sixteen feet of RG-58/U coax is included in the price. For more information, contact your local ham radio dealer or *j•Com, Box 194, Ben Lomond CA 95005; (408) 335–9120, Fax: (408) 335–9121.* Or circle Reader Service No. 201.

AMATEUR RADIO ENGINEERING

A.R.E. has introduced a new external speaker, plus a 2- to 4-digit DTMF decoder, for use with VHF/UHF radios. The Silencer (Model ARE-10) is user-programmable for a DTMF code which enables (opens) the speaker for approximately 10 seconds when the proper tone is received. When the correct code is received an LED lights on the ARE-10 to tell the user that a call has been received. The ARE-10 allows the user to set the front toggle switch to MONITOR when they want to hear everything being said on the frequency. The toggle switch also has a momentary position which is used to turn the LED off after a call has been received.

The ARE-10 provides a way for everyone to economically have selective calling. It also allows family members or co-workers to avoid hearing everything being said on today's busy frequencies. Rather than turn the radio off to eliminate the annoyance, just set the toggle switch to DECODE and The Silencer will eliminate all of the chatter, while allowing the user to still receive calls. To connect the ARE to a radio, all that is necessary is to plug the ARE-10 into the external speaker jack on the radio and connect its power lead to 12 volts DC. Simple and fast.

The ARE-10 includes a high quality speaker that will improve the audio from today's transceivers. It is compact, measuring just 3" (w) x 3-1/4" (d) x 4-3/8" (h). It is priced at $99.95 and is available from your local amateur radio dealer. For more information, contact *Amateur Radio Engineering, P.O. Box 169, Redmond WA 98073; (206) 882–2837, Fax: (206) 861–5780.* Or circle Reader Service No. 203.



NCG

NCG/COMET Antenna has released the CX-224 2m/220/440 MHz Triband Mobile Antenna, the first ever with gain. The high-quality construction and materials COMET is known for are used to create a durable antenna with excellent appearance and performance. The CX-224 radiates 1/2 wave on 2m with 2.15 dBi gain, a 5/8 wave on 220 MHz with 3.2 dBi gain, and 2-5/8 waves on 440 MHz with 5.5 dBi gain. It is 37" long and is made with a hinged base to allow the element to fold over. It has a PL-259 connector, and is also available with an NMO connector (CX-224NMO). A triplexer is also available: CFX-324A has coax leads, CFX-324B does not; both have UHF connectors. This new antenna and triplexer are now available from most amateur radio dealers, along with a wide variety of trunk-lip, hatch-back and rain-gutter mounts for easy installations.

The introductory price for the CX-224 is $79.95. For more information, contact *NCG, 1275 North Grove St., Anaheim CA 92806; (714) 630–4541, Fax: (714) 630–7024.* Or circle Reader Service No. 202.

MOUSER ELECTRONICS

Mouser Electronics has released a new purchasing manual, #570. This comprehensive reference guide provides up-to-date product data and pricing on over 36,000 electronic components and over 80 manufacturers. Product index tabs are provided for locating particular products quickly.There is a quick index on the front cover. To order your free copy of this catalog, contact *Mouser Electronics, P.O. Box 699, Mansfield TX 76063; (817) 483–0165, (800) 992–9943, Fax: (817) 483–8157.* Or circle Reader Service No. 204.

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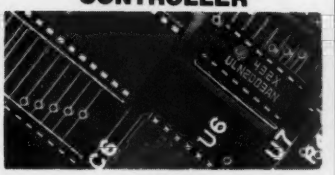

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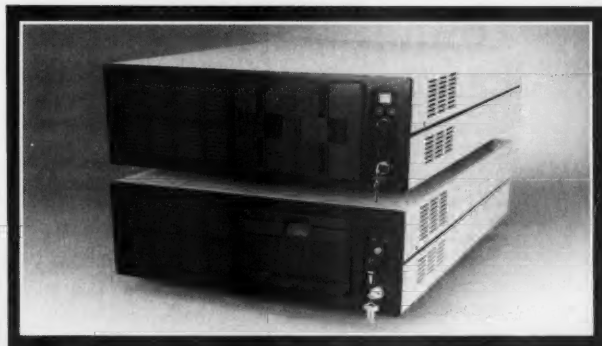

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Brain Twisters

Well, I knew I was opening a can of worms when I started the topics of modulation and receivers. Folks, the definition of what is going on in modulation has always been somewhat controversial. John WR0W wrote to take me to task on several issues. He points out that the math can be shown to prove that in AM, the carrier *does* in fact change amplitude, and also that it does not! It all depends upon how you look at it. Physically, the same is true. If you look at a modulated AM signal on an oscilloscope, which shows you amplitude versus time, it seems quite clear that the whole signal is changing amplitude, all the way down to zero at times. Yet, if you look at that same signal on a spectrum analyzer, which shows you amplitude versus frequency, you can see the unvarying carrier and the two varying sidebands. How can they both be true?

Perhaps they can be. Consider this: Modulation changes the shape of the carrier wave; if it is changing amplitude, the individual waves can't be perfect sine waves anymore because one side must be getting bigger or smaller. Such changing shapes, when not differentiated by how their energy is spread across various frequencies (as they would be in a spectrum graph), form a net result of change of amplitude *of the total signal*, as the oscilloscope shows. But, when we examine the effects of the shape changes by how the resultant energy is spread across the spectrum (using the spectrum analyzer), it appears that the part of the total energy that is purely sinusoidal (and thus unmodulated) is not changing. OK, I know I'm only adding more controversy, folks. Please don't write complaining about this attempt at an explanation. No one else has ever resolved the issue, and I sure don't expect to be the first! But, as you can see, modulation is rather complex. And, as John points out, FM is even more complex when subjected to mathematical analysis. Thanks, John, for some thought-provoking points.

By the way, John, I, too, have heard very conflicting reports about the proper care of NiCd batteries. The "smart discharger" idea seems great to me, but knowledgable industry folks say no, no, no! The information I presented on the subject came from many years of experience with the annoying little buggers. I, for one, can't wait for nickel-hydride or some other new technology to obsolete NiCds once and for all.

FM-SSB?

Here's another brain twister: SSB transmitters can be used for a kind of FM, and hams do it all the time. Say what?

It's true. SSB, which *really* changes the shape of the carrier in strange ways, has an odd characteristic. If you feed a pure audio sine wave into an SSB transmitter, all you get out is a pure carrier, offset from the dial frequency by the frequency of the audio tone! So, what happens if you vary the frequency of the audio tone? You guessed it, it makes the transmitter's frequency wiggle along with it. Yup, FM! Well, not exactly. In real FM, the carrier frequency deviates proportionally to the amplitude of the audio signal, not its frequency. But the output of this FM-SSB is just like FM as far as thespectrum is concerned; it's a wiggling carrier of constant amplitude. So where do we use it? Well, RTTY, which is Frequency Shift Keying, is a form of two-state FM. It's either at one frequency or the other, with the two frequencies representing digital ones and zeros, or "mark" and "space."

FSK vs. AFSK

True FSK is produced by making the on-off voltages which represent the digital data directly shift the transmitter's frequency back and forth between the two values. This can be done by switching between two oscillators or, perhaps, shifting a PLL. Probably the most common method is to use a varactor diode (varicap). It really doesn't matter.

AFSK, which I suspect is more commonly used these days, relies on the FM-SSB technique I just described: Audio tones are fed into the transmitter, forcing it to produce a carrier which follows the tones.

Spectrally, the two techniques produce *exactly* the same result, but there's a difference in operation. With true FSK, your frequency display shows one of the two frequencies being used (usually "space," or digital zero). With AFSK, your display is offset from the frequencies you are actually putting out because they are both the result of modulation. Thus, they are in the sideband area. So, if you are on 14.080 MHz AFSK (USB), you are actually transmitting around 14.082 MHz. Keep that in mind if you should wander near the band edges. Just like on SSB, you must keep all your sideband emissions within the band. Even with true FSK, you must consider the two frequencies being generated and the sidebands resulting from their generation. A 170-Hz-shift signal is wider than 170 Hz, because it is modulated with the data!

SSTV is a more complex case. In that mode, a constant-amplitude sine wave audio tone is made to frequency

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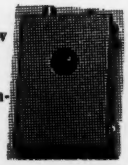

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modulate in step with the amplitude of the slowed-down video signal. Then that "audio FM" signal is applied to the SSB transmitter, making it frequency modulate with the frequency of the audio, as described above. The result is that the transmitter's output frequency wiggles in step with the original video signal's amplitude. That, my friends, is real FM. On SSB. On 20 meters. Perfectly legal, too. And it occupies well under the allowed 3 kHz bandwidth, so why not? If it weren't for this system, 252SSTV would be darn near impossible, because the fading, QRM and static would make the video unwatchable. All in all, it's pretty clever.

FM Voice Level

When signals get weak, there's a natural tendency to talk louder. It makes intuitive sense: If someone can't hear you, yell! Actually, it kind of works, up to a point, on SSB. The ALC circuit in the transmitter keeps the loudest speech sounds from overdriving the output (at least it's supposed to), while the softer sounds are raised in level. Sounds like a speech processor, doesn't it? On FM, however, the situation is much different. Before we get to why, we need to look at FM a little more.

How Big Does It Get?

With FM, there is no theoretical maximum modulation as there is with AM and SSB. After all, it's just the frequency of the carrier wiggling, and we can wiggle it as far as we want, right? In practice, there are limits to how far it can go because the tuned RF amplifiers have bandwidth limits. But those limits can be pretty wide, so we can ignore them here.

Without some circuitry to limit the mike gain, we can deviate an FM transmitter into infinity. So just what is "maximum" modulation in an FM system? It corresponds to the maximum deviation which can be turned into a *linear* change in the recovered audio voltage *in the receiver's detector*. This limit is set by the design of the receiver, not by any inherent theoretical characteristic of the transmitter. If the transmitter deviates farther than the receiver is designed to accept, it will cause terrible distortion due to the detector's being unable to remain linear at the extremes. Heck, everything has some limits!

The wider the deviation, the lower the noise level, provided there is plenty of signal. That's because apparent random deviation caused by noise in the transmitting modulator and the receiver's front end represents a smaller percentage of the total. Obviously, if you have 500 Hz maximum deviation (a ridiculously small amount), then a random deviation of, say, 2 Hz is much more serious than if maximum deviation is 15 kHz. So why not use lots of deviation? Two reasons.

First, it takes up lots of bandwidth. Ever wonder why commercial FM stations are spaced at least 200 kHz apart? Commercial stations use lots of deviation, thus lots of bandwidth. Let's see, we could fit 20 stations on 2 meters . . . not too good.

Second, it makes the signal appear much weaker at the receiver because the available energy is being spread over much wider bandwidth, making the amount at any one frequency much less. That's why your favorite FM rock station needs those 100,000 watts to be clearly heard for a 30-mile radius, while you can hear a 100-watt repeater 50 or more miles away. By using narrow bandwidth, we greatly expand range at the expense of fidelity.

"Here's another brain twister: SSB transmitters can be used for a kind of FM, and hams do it all the time. Say what?"

Here's the Why

And that's why yelling on a weak FM link actually makes you *harder* to hear! Have you ever noticed that a weak FM signal, amateur or commercial, gets the most distorted on audio peaks? Just when the cymbal crashes or the voice is the loudest, it sounds the worst. When you deviate your transmitter to the max, your transmitter's energy is spread wider, so it seems weaker. Of course, if you whisper, you may be lost in the noise of the weak reception. There is an optimum level, and it is best found through experimentation with your particular rig. Next time you're real scratchy into the repeater, try talking a little bit *softer* and I'll bet you get heard better! By the way, I have never heard anyone but myself do this, but I promise, it works.

One Last Brain Twister

You've probably heard this one: At certain audio modulating frequencies, the carrier in an FM transmitter actually disappears! Yes, it does, but that does not mean that the transmitter's *output signal* disappears! Before you go grabbing the antenna to see if it is true, consider this: The transmitter is still putting out full power—it's all in the sidebands. You still don't want to touch it. Ouch!

73 and see you all next month! de KB1UM.

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SPECIAL EVENTS

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MAY 2

GRAND JUNCTION, CO The Western Colorado ARC will hold its annual Hamfest in Liff Auditorium at Mesa State College from 9 AM–2 PM. Seminars. VE Exams. Talk-in on 146.94. Call ***Ernie N9OEQ, (303) 242–6035,*** or ***Bob N9OKL, (303) 434–8604.***

EAST LIVERPOOL, OH The Triangle ARC will hold their first annual Hamfest at the Calcutta Fire Hall. Talk-in on 146.10/.70 rptr. Contact ***Dick Sisley K8JKB, Secretary, 1218 Northside Ave., East Liverpool OH 43920.***

SONOMA, CA The Valley of the Moon ARC will hold its semi-annual "ham" and egg breakfast, VE exam, swapmeet, ARRL Hamfest, ATV, packet radio demonstration starting at 8:00 AM at the Sonoma Community Center, 276 East Napa St. Fishing in afternoon. VE exams will be walk-in with registration at 10:00 AM. Testing at 11:00 AM. Swap spaces $10. Breakfast $5. Admission free. Talk-in on 147.47 simplex and 144.75/145.35 rptr. Contact***Darrell WD6BOR at (707) 996–4494.***

MAY 2-3

ABILENE, TX The Key City ARC will sponsor the ARRL West Texas Section Convention and Hamfest at the Abilene Civic Center from 8 AM–5 PM Sat., and from 9 AM–3 PM Sun. Free parking. VE Exams. Wheelchair access. Tables $5 each. Pre-registration $6 (must be received by Apr. 28), $7 at the door. Talk-in on 146.160/.760. Contact ***Peg Richard KA4UPA, 1442 Lakeside Dr., Abilene TX 79602. (915) 672–8889.***

SIERRA VISTA, AZ The Cochise ARA will hold its annual Hamfest at the club training facility. Drive 5 miles east of town on State RT. 90 and then 2 miles south on Moson Rd. VE exams. Overnight RV camping (no hookups) available to club members. Talk-in on 146.52 or 146.76(-.6). Handicap facilities. Contact ***N7INK (602) 378–3155 after 6 PM*** or write to ***CARA, PO Box 1855, Sierra Vista AZ 85636.***

MAY 3

ST. PETERSBURG, FL The St. Petersburg ARC will sponsor a Hamfest at Lake Maggiore Park (9th St. & 38th Ave. So.) from 8 AM–1 PM. Flea Market. Tailgating. Free Admission. Bring a picnic lunch and eat under the park shelters. Talk-in on 147.06 rptr. Lake Maggiore Park is a city park, so there will be no commercial dealers. Contact ***Robert Russell N4ZMQ, (813) 896–2518.***

NEW CASTLE, DE The Penn-Del ARC will sponsor the Penn-Del Hamfest at the Nur Temple, 198 S. DuPont Hwy., (RT 13 near US 40 split), from 8:30 AM–2 PM, rain or shine. Set-up at 7 AM. Indoor/outdoor reserved swap tables, tailgating, VE Exams, Commercial exhibitors. Indoor tables with electricity, $10; without electricity, $8. Outdoor tables are $6. Tailgating $5. General admission $4. Reservations required for swap tables: send check to ***PO Box 1964, Boothwyn PA 19061***. Make checks payable to ***PENN-DEL ARC***. For info call ***(215) 497–2124.***

MAY 9

MANITOWOC, WI The Mancorad RC will sponsor a Ham/Computer/Flea Market at the Manitowoc County Expo Ctr., intersection of Hwys 42-151 and I-43 on Co. R. from 8 AM–3:30 PM. Set-up at 7 AM. VE Exams, all classes. Camping available via ***Manitowoc Co. Expo Ctr., (414) 683–4378.*** Advance tickets $2, $3 at the door. 8' tables $5 with outlet, $3 without. Talk-in on 146.01/.61. Contact: via SASE to ***Mancorad R.C., Box 204, Manitowoc WI 54221-0204*** or call (days) ***"John" (414) 682–9151;*** (nights) ***"Lou" (414) 682–2557.***

MAY 10

ATHENS, OH The Athens County ARA will hold its 13th annual Hamfest from 8 AM–3 PM at the City Recreation Center. Take the East St. exit on either US Route 33 or US Route 50, and look for signs to the Hamfest. Admission is $4 a person, but in honor of Mother's Day, YLs and spouses of male hams will be allowed in free. Free paved outdoor flea market space adjacent to building for tailgaters and those bringing their own tables the day of the event. Indoor space available by advance registration only. To register, contact ***John Biddle WD8JLM, 80 Wonder Hills Dr., Athens OH 45701. (614) 594–8901*** (after 6 PM). Talk-in on the club rptr. at 145.15+ MHz. For info write to ***Carl J. Denbow KA8JXG, 63 Morris Ave., Athens OH 45701-1939.***

WHEATON, IL GMRS of Illinois, Inc., will hold their Bi-annual Fest from 8 AM–1 PM at the DuPage County Fairgrounds, Manchester Rd. Set-up will begin at 6 AM. Advance tickets $4; $5 at the door. Tables $10 each. Free outdoor Flea Market spaces. Ladies admitted free. For info call ***Bob, (708) 690–1492.***

MAY 15-17

VENTURA, CA The 1992 West Coast VHF/UHF Conference, sponsored by the Ventura County ARC, will be held at the Holiday Inn on the Beach, 450 East Harbor Blvd. Free parking. Take advantage of the special hotel Conference Rate of only $55 per night, double occupancy (plus room tax). Be sure to mention the conference. Offer valid until May 1. Hotel reservations: ***1–800–842–0800***. Sat. night Banquet $25 (pre-register only). Sun. morning Breakfast, $10. No-Code Tech class and Exams, call ***(714) 979–2633.*** There will be a list of proceedings available at the Conference for $10. Make checks payable to ***Ventura County ARC*** and mail payment to ***VCARC, PO Box 2103, Oxnard CA 93033.*** For info call ***(805) 647–4294.*** No refunds after May 6. For exhibit space call ***(805) 264–1978.***

MAY 16

COLORADO SPRINGS, CO Pikes Peak RAA will host the largest Ham-Computer Swap in Colorado from 8 AM–4 PM. Admission $3. Tables $10. Contact ***Al N9CMW*** or ***Frances N9IUT, (719) 473–1660.*** Write: ***PPRAA, PO Box 16521, Colorado Springs CO 80935.*** VE Exams. Free Parking. Take Filmore Exit East off I-25 to Union, then right to Mega-Mart, 1801 Union Blvd. Talk-in on 146.37/.97 or 146.52.

EPHRATA, PA The Lancaster County Hamfest, sponsored by the Ephrata Area Repeater Society, Inc., will be held at the Ephrata Senior High School, 803 Oak Blvd., beginning at 8 AM. Set-up at 6:30 AM. All sites handicap accessible. VE Exams at 9 AM. Admission $4. Tailgating $3. Inside tables $6. Talk-in on 145.45 MHz, 146.52 MHz and 444.65 MHz. For info and reservations, call ***Tom Youngberg K3RZF, (215) 267–2514*** after 6 PM; or write ***E.A.R.S., 906 Clearview Ave., Ephrata PA 17522.***

CADILLAC, MI The Wexaukee ARA will hold their annual Swap and Shop at the Cadillac Middle School, 500 Chestnut St., from 8 AM–1 PM. Admission $3. Tables $6. Talk-in on 146.38/.98 rptr. Call ***Dan Schmidt KE8KU, (616) 775–0998;*** or write ***Wexaukee ARA, PO Box 163, Cadillac MI 49601-0163.***

NO. SMITHFIELD, RI The Rhode Island Amateur FM Repeater Service, Inc., will hold their annual Spring Auction and Flea Market at the VFW Post 6342, Main St., beginning at 8 AM. Take the Forestdale exit off Route 146 in No. Smithfield, take a left at the end of the ramp and go six tenths of a mile to the Post (on your right just before the Village Haven Restaurant). Flea Market spaces $5 each. There will be an auction from 11 AM–3 PM. Donation $1. Talk-in on 146.76. For info contact ***Rick Fairweather K1KYI, 106 Chaplin St., Pawtucket RI 02861***, or call ***(401) 725–7507*** between 7 and 8 PM.

AMENIA, NY A Hamfest sponsored by the Southern Berkshire ARC, will be held at the Amenia NY Firehouse (US Rte 44 or NY 22 to Amenia stoplight, east on 343 one block to Mechanic St., to the firehouse. From Connecticut, west on Rte 4 to Sharon, then west on 343 to Amenia. Pavilion tables $4. Admission $3. Talk-in on 147.285/.885. SASE to ***Ed Wilbur WB1CEI, PO Box 547, Sharon CT 06069. (203) 364–5206*** eves.

KLAMATH FALLS, OR The First Annual South Central Oregon Hamfest will be held at the Oregon Institute of Technology campus. Exhibitor booths, Flea Market tables, lasers, and license exams for all classes, are among the events planned. 10' tables $10 each. Contact ***Hollis Kiger W7UFM, (503) 882–5129*** or ***Dick Switzer KB7DWX, (503) 882–1300.***

MARSHALLTOWN, IA The Central Iowa RAS will hold its Hamfest at the Marshalltown Community College–1/4 mile south of HWY 30 just east of HWY 14. Talk-in on 146.28/.88. VE exams, sign up at 10:00 AM–2 PM. For info call ***Chuck Dennis WB9ZKG, Toledo IA. (515) 484–4837.*** Tickets $3 in advance and $4 at the gate. Call or write ***Charles Lynk W9DYS, 2460 Reed Ave., Marshalltown IA 50158. (515) 753–6925*** or ***Brian Krumm N9MXK, 911 South 8th Ave., Marshalltown IA 50158. (515) 752–9658.*** Tailgating.

MAY 16-17

HARTWELL, GA The Lake Hartwell Hamfest will be held at Hartwell Group Camp Sat. and Sun. ARRL sponsored VE Exams for all classes will be held on Sat. the 16th.

BIRMINGHAM, AL The BirmingHamfest will be held indoors at the Birmingham-Jefferson Civic Center. Talk-in on W4CUE/R, 146.880 MHz. Commercial exhibitors, Flea market, Electronic equipment, Awards, Amateur radio license tests (Sunday only). Adult admission $5. Reservations and information, Write: ***BirmingHamfest '92, PO Box 94775, Birmingham, Al 35220*** or call ***(205) 979–7039***

May 17

WHEELING, WV The Triple States RAC will sponsor the 1992 TSRAC Wheeling Hamfest/Computer Fair from 8 AM–3 PM at Wheeling Park.

QUEENS, NY The Hall of Science ARC Hamfest will be held at the New York Hall of Science parking lot—Flushing Meadow Park, 47-01 111th St., Queens NY. Doors open for Vendors to set-up at 7:30 AM; Buyers admitted at 9 AM. Free Parking. Admission by donation; Buyers $5, Sellers $8 per space. Talk-in on 445.175 NB2A rptr. Contact (eves.) ***Charles Becker WA2JUJ, (516) 694–3955*** or ***Arnie Schiffman WB2YXB, (718) 343–0172.***

CAMBRIDGE, MA The MIT Electronics Research Society, the MIT Radio Society, and the Harvard Wireless Club will co-sponsor a Tailgate Flea Market for electronics, computer and amateur radio, from 9 AM–2 PM (rain or shine) at Albany and Main St. Free off-street parking. Covered tailgate area for 400 sellers, $8 per space at the gate; $5 in advance (includes 1 admission). Set-up at 7 AM. For reservations or info call ***(617) 253–3776***. Mail advance reservations before May 5th to ***W1GSL, PO Box 82 MIT BR., Cambridge MA 02139.*** Talk-in on 146.52 and 449.725/444.725–pl 2A, W1XM rptr.

SACRAMENTO, CA The North Hills RC will hold Hamfest '92, starting at 8 AM PST, at the Carmichael Elk's Lodge at Hackberry Lane and Cypress Ave. Talk-in will be on the K6IS rptrs. on 145.190 MHz and 224.400 MHz. Inside tables and outside spaces are available. There will be demonstrations of Oscar, Packet, and ATV. Admission $1. This is the BIG ONE in the Sacramento Valley Section.

May 17-19

PEOTONE, IL The Kankakee ARS will hold its annual Hamfest at the Will County Fairgrounds on May 19 from 8 AM–2 PM. Indoor exhibit area, ARRL booth, large outdoor flea market. Free Parking. Set-up May 17 from 6 AM-8 AM. Admission $3.50 in advance, $4.00 at the door. Take I-57 south of Chicago. Exit 327 east to Peotone. Fairgrounds one mile on left. Talk-in on 146.34/.94. More information from ***KARS C/O Frank DalCanton KA9PWW, 117 Kristina Dr., Bourbonnais, Il. 60914. (815) 932–5950 after 7 PM CST***

May 22-24

TULSA, OK The Green Country Hamfest will be held at the Maxwell Convention Center in down-town Tulsa, located on W. 7th St. between Denver and Houston Avenues. Large indoor flea market, new equipment dealers, forums, V.E. exams, alternate activities for non-amateurs. Admission $8 in advance/$10 at the door. Free parking. Flea market tables $6 in advance and $8 at the door. RV parking. Talk-in on 146.28/.88 Tulsa Rptr. Hamfest information ***(918) 272–3081. PO Box 470132 Tulsa, OK. 74147–0132***

May 23-24

YAKIMA, WA The Yakima ARC W7AQ will sponsor the Washington State Hamfest and the 1st Annual NW Packet Radio Conference. Seminars for all levels of packet radio. VE testing for all levels on Saturday, May 23rd at 1:30 PM. Walk-ins will be accepted. New dealer displays as well as swap/shop tables. Early Bird Breakfast, Sat. and Sun. at 7:30 AM. Banquet Saturday evening at 6:30 PM. Cost $10.50 per person. Talk-in on 146.06/.66. Take 16th Ave. exit off HWY 12, South on 16th to Chestnut Ave., East on Chestnut to 14th, South on 14th to Entrance of St. Paul's School Gym. Admission $5 in advance, $6 at the door. Contact ***Dick Umberger N7HHU, W7AQ Yakima ARC, PO Box 9211, Yakima, WA 98909, (509) 453–8632 days.***

May 24

YOUNGSTOWN, OH The Twenty Over Nine Radio Club is sponsoring a Hamfest at the Canfield Fairgrounds from 8 AM–3 PM. Tickets are $3 in advance and $4 at the door. Indoor tables are $8. Flea market $1. Security provided. Free parking. Talk-in on 147.315. For directions 145.275. Contact ***Twenty Nine Radio Club, 42 South Whitney, Youngstown OH 44509.***

May 31

MILFORD, CT This schedule for 1992 Exams-By the Coastline ARA. All class Exams. Contact: ***Gary NB1M (203) 933–5125-West Haven*** or ***Dick WA1YQE (203) 874–1014-Milford.*** Place: Fowler Building, 145 Bridgeport Ave., Milford CT. Time: 12 Noon. Walk-Ins.

June 6

TEANECK, NJ The ARRL Hudson Division Convention Co-Sponsored by the Bergen ARA, Radio Amateur Telecommunications Society, and the Hudson ARC will be held at the Fairleigh Dickinson University from 7:00AM–4:00PM. ARRL and FCC forums, technical seminars, VE testing, Hamfest. Admission $5, children under 12 free. Vending space $30 per indoor space, $10 outdoor tailgating space, $25 per outdoor space with power. From NYC take Rt. 4 West to River Rd. exit in Teaneck, follow signs to convention. From Rt. 4 East, take River Rd. exit and follow signs. Talk-in on 146.790-6 and 146.700-6. Contact ***Jim Joyce K2ZB, (201) 664–6725.*** For VE info, call ***Pete Adely K2MHP, (201) 796–6622.*** Please, no calls after 10 PM.

June 7

CHELSEA, MI The Chelsea ARC will sponsor a SWAP 'N SHOP. Talk-in:146.980 Chealsea Rptr 8 ' tables $9, trunk sale $3 per space, special handicapped parking. Gates open at 6:00 AM for sellers. Donation: $3. YL'S, XYL'S, & kids under 12 free. Ladies tables welcome. For more info send SASE or call ***(313) 475–1795, Robert Schantz, 416 Wilkinson Street, Chelsea MI 48118.***

NEWINGTON, CT The Newington ARL will hold its annual amateur radio and computer hamfest from 9:00 AM–2 PM at Newington High School, Rte. 173 (Willard Ave.) just north of Rts. 173 (Cedar St). Tailgating (weather permitting), refreshments, guided tours of ARRL HQ and W1AW. VE exams (no walk-ins). Talk-in on 144.85/145.45, 223.24/224.84, 443.05/448.05, 146.52. Admission $3. Tables $10 in advance, $15 at the door. Contact ***Les Andrew KA1KRP, c/o NARL, 68 Wildermere Ave., Waterbury CT 06705, (203) 523–0453 (SASE for confirmation).*** Exam Appointments: SASE to ***Susan Fredrickson WM1B, PO Box 165, Pleasant Valley CT 06062.***

MANASSAS, VA The Ole Virginia Hams ARC will sponsor the Manassas Hamfest and Computer Show at the William County Fairgrounds. Take 166 west to Rte. 234 then south on 234 to Fairgrounds. Open to public at 8:00 AM, Tailgaters 7:00 AM. Admission $5 each. Tailgating $5 additional per space. Wheelchair accessible. Talk-in on Manassas rptr. 146.37/.97 and 223.06/224.66. Commercial vendors contact ***Woody KD4DEG at (703) 368–5180.*** Contact ***Rosemary KI4VO at (703) 361–5255.***

PITTSBURGH, PA The Breeze Shooters will host their 38th annual Hamfest/Computerfest at the Butler County Farm Show Grounds, on PA. RT. 68 west of Butler. Admission $1 per person at the gate. Free parking. Free tailgate vending. Handicapped parking. Tables $10 each by prepaid reserva-

tion. Contact ***Rey Whanger W3BIS, Box 8, RD#2, Cove Road, Cheswick PA 15024. (412) 828-3694***

SPECIAL EVENT STATIONS

May 1–2

BAKER, CA The Ancient and Honorable Order Of E Clampus Vitus, Billy Holcomb Chapter ARC will operate a special event station KC6LUC from 1700Z–0400Z to commemorate **"The Historical Chicago to Los Angeles Route 66."** Operations will be in the General 40, 20, 15 and the Novice portion of 10 meters. For a Certificate, send QSL and SASE to ***ECV ARC, 1458 Albright Ave., Upland, CA. 91786***

May 2–3

MEMPHIS, TN The Mid-South ARA will operate W4EM May 2 1300Z–0500Z May 3 to celebrate Memphis in May International Festival. This year's honored country is Italy. Operation will be in the lower 50 kHz of the SSB General 80–12 meter and the Novice 10 meter subbands. For certificate, send QSL and a 9 x 12 inch SASE to ***Mara W4EM, 2966 Cordell, Memphis TN 38118.***

May 6–7

SIOUX CITY, IA The Siouxland ARA will operate KØAAR from 1500Z–2100Z to celebrate the 120th anniversary of the 1500 mile steamboat river race between The Nelle Peck and The Far West. Phone: 7.243, 14.255, 21.355, 28.355. For certificate send SASE to **KØAAR, 3407 Jennings St., Sioux City IA 51104**

May 8

FRANKLIN, MA Tri County AR will operate WW1H 1400Z–2100Z to Commemorate the 15th Anniversary of Tri County Regional Vocational Technical High School. Operations will be in the lower end of the 10 meter Novice phone band and the 20 meter General phone band. For certificates, send QSL and a SASE to ***WW1H Tri County Amateur Radio, 147 Pond Street, Franklin MA 02038.***

May 8–9

FORT PIERCE, FL The Fort Pierce ARC will operate KN4RY; 1600Z–2300Z May 8 and 1400Z–2100Z May 9 to commemorate the 5th Annual Trail Ride of the Florida Cracker Trail Assn. Operation will be in the 40, 20, 15, and the Novice portion of the 10 meter phone band. For Certificates please send a QSL and large 9 x 12 SASE (2 units of postage) to ***W3DHN, 18 Cordillera, Fort Pierce FL 34951.***

May 9–10

LAS VEGAS, NV The Nevada QSP Party sponsored by the Frontier ARS will be held from 0000Z May 9 to 0600Z May 10. Work stations once per band per mode. Exchange RS(T), and State/Province/Country (Nevada Stations also give county). Frequencies: 6 through 160 meters modes–CW/SSB/RTTY/SSTV/PACKET. Scoring–1 Pt. Phone QSO, 2 Pt. other modes. Non–Nevada Stations multiply by number of Nevada Counties, Nevada Stations multiply by State/Province/Country Total. Awards–Certificates to top score each State/Province/DXCC Country General and above, Novice & Tech. Mail Entry By June 1, 1992 to:***Jim Frye NW7O, 4120 Oakhill Ave., Las Vegas, NV 89121.***

GRAYS HARBOR, WA The Grays Harbor ARC will be conducting a special events station commemorating the 200th anniversary of the discovery of Grays Harbor. On May 7th, 1792, Captain Robert Gray, in his ship Columbia, sailed into the harbor. Look for W7ZA from 0000Z, May 9th to 2400Z May 10th on the bottom part of the General phone band on 15 thru 80 meters, on Novice phone portion of 10 meters and 40 up from the bottom of the CW bands on 10 thru 80. For a special QSL card please send your QSL card and a SASE (Legal Size) to:***ARS:KA7AIR Joe Ledesma, 516 6th Street, Hoquiam, WA 98550.***

MOUNT VERNON, VA Members of the Mount Vernon ARC will operate 1400–2100Z from locations on the original Mount Vernon estate of George Washington to celebrate the 250th anniversary of the founding of Fairfax County, VA. CW–7.130, 14.040, 21.110; Phone–7.227, 14.250, 21.325, 28.325; VHF voice 146.655; and VHF and HF packet on 145.670 (DCA and WASHDC nodes). For certificate, send QSL and a 9 x 12 inch or #10 SASE to ***Steve Schneider WB4EEA, 8602 Cushman Place, Alexandria VA 22308.*** DX stations send 2 IRCs with QSL and SASE. QSL card confirmation will be sent in addition to certificate only if specifically requested.

WALL TOWNSHIP, NJ The Ocean-Monmouth ARC will be sponsoring the Commemoration of Marconi's Memorial Tower Radio Sight Circa 1914. Omarc will operate KC2Q from 1600Z on May 9 to 1900Z on May 10. Phone at the low end of the General portion of the 15–75 meter band, Novice portion of 10 meter band, CW will be on 3540, 7045, 14045, 21045 MHz. For flat certificate, send 1 green stamp, or SASE for folded, to ***Omarc, PO Box 75, Bradley Beach NJ 07720.*** *Visitors welcome. Talk-in 145.110 -600.*

May 10

PROMONTORY, UT The Ogden ARC will operate KE7QV from driving of the Golden Spike, Promontory Summit, UT: operations will be from 0001Z–2100Z on one of the following: 3.970, 7.270, 14.280, 21.375, and 28.415 MHz. Send QSL and SASE to ***Ogden ARC, PO Box 3353, Ogden UT 84409.***

May 13

TOWNSVILLE, AUSTRALIA The National commemoration of the 50th Anniversary of the Battle of the Coral Sea. During May 1–13, a special event callsign, VI4BCS (Victor India Four Battle Coral Sea), will be activated from the Club's premises at Green St., West End, Townsville. A special QSL card will be available for all QSO's to VI4BCS. Celebrations include a troop train from Brisbane bringing 300 ex-servicemen and women to Townsville, arrival of four United States Navy ships and three Australian Navy Ships on May 8 to unveil the $100,000 Coral Sea memorial in Anzac Park. Please phone ***Bob Mann VK4WJ on (077) 797869*** or ***Roger Cordukes VK4CD on (077) 740221*** or write to ***TARC Inc, P.O. Box 964, Townsville, 4810 Australia.*** Packet Address: ***VK4WK4AFS#NQ.QLD.AUS.OC***

May 14–15

FORT MCCLELLAN, AL 1992 marks the Golden Anniversary of The WAC and the WAAC. The reunion will be held at the historical home of the Women's Army Corps. This year's celebration honors Maj. Gen. Mary E. Clarke. Two-way radio communications on MARS and Amateur Radio frequencies. Certificates will be awarded to all WAC's and WAAC's who participate in the reunion on the air. A QSL card will be sent for the radio operators who assisted them. The station will operate on 28.350, 21.350, 14.285, 7.272, and 3.900 MHz using the callsign N4MOK. Contact the ***WAC Foundation at (205) 848-3512*** or the ***Fort McClellan Army MARS station at (205) 848-4818.***

May 16–17

GLASGOW, KY The Mammoth Cave ARC and the Kentucky Colonels ARC will operate KD4SS from Barren River State Park to commemorate the Kentucky Bicentennial and can be found in the General portions of 10 thru 80 meters. Operation will begin at 1700Z on May 16–1700Z on May 17. ***QSL KD4SS, 309 East Main Street, Glasgow KY 42141.*** SASE please.

RALEIGH, NC The Raleigh ARS will operate W4DW to celebrate the bicentennial of the capital city, from 1500 UTC–2200 UTC on both days. Operation will be in the General portion of the voice bands on 20, 40, and 75 meters, and the Novice portion of 10 meters. For commemorative QSL card send a #10 SASE to ***RARS 200, PO Box 17124, Raleigh NC 27619.***

ST. CHARLES, MO The St. Charles ARC will operate WBØHSI from 1300Z to 2100Z as part of the Lewis and Clark Rendezvous. We will transmit on 7265, 14265, 21365, 28465, 146.67, and AO-13 145.935 (mode B) and 435.970 (mode J) as propagation and QRM permit. For 8.5 x 11 certificate, send a large SASE to the ***St. Charles ARC, PO Box 1429, St. Charles MO 63302-1429.***

WINFIELD, IL The DuPage ARC will operate club station W9DUP, to commemorate Armed Forces Day. Operation will be from the Cantigny War Museum. This event is from 1600 UTC–2300 UTC. Suggested frequencies are 7.250, 14.290, 28.400 SSB and 145.25 (-.600). For a certificate, send QSL and SASE to ***Jack Carr NV9S, DARC PO Box 71, Clarendon Hills IL, 60514.***

May 16–18

HOUSTON, TX The Brazos Valley ARC will operate WD5DRB from 0000Z May 16–0000Z May 18 to celebrate B-VARC's 15th Anniversary. Operation will be in lower 25 kHz of the General 80, 40, 20, and 15 meter subbands, and 28.488 MHz of the Novice subband, with special endorsement for past or present B-VARC members with callsigns. For a certificate, send QSL and SASE to ***B-VARC, PO Box 1630, Missouri City, TX 77459-1630.***

SOUTHFIELD, MI The 1992 QSO Party will be sponsored by the Oak Park ARC. Phone and CW are combined into one contest. Frequencies CW: 1810, 3540, 3725, 7035, 7125, 14035, 21035, 21125, 28035, 28125. Phone: 1855, 3805, 7280, 14280, 21380, 28580. VHF: 50.125, 145.025, 146.52. Scoring: MI Stations: 1 point per QSO X (States + Countries + Michigan counties) on phone. VE counts as a country. Five points for each W8MB contact. Non-Michigan Stations: QSO points X Michigan Counties. One point for each Michigan phone QSO and two points for each CW contact. Five points for each club station contact with W8MB/W8MB/mobile. No rptr. contacts are allowed. Awards. Certificates. Send logs to ***Mark Shaw K8ED, 27600 Franklin Road, Apt. 816, Southfield MI 48034.***

May 17

CRESSKILL, NJ The Bergen ARA, in conjunction with Camp Merritt American Legion Post 21, will operate K2UFM from 1300Z–2100Z to celebrate the 75th anniversary of Camp Merritt and the Rededication of the Camp Merritt Memorial Monument. Operation in General phone portion of 40-80-20-15 meter bands and the Novice portion of the 10 meter band. For certificate, send QSL and SASE 9 x 12 envelope to ***Warren P. Hagar K2UFM, 31 Forest Drive, Hillsdale NJ 07642-1351.***

May 22–June 14

WIESBADEN, GERMANY The Wiesbaden Germany ARC will operate station HB/0DA1WA during its 17th annual DXpedition to Liechtenstein. Operation will be 24 hr/day on all bands 160m through 10m, SSB and CW. QSL card will be printed and should be through DJ0LC for stations outside the U.S. and Canada, or through KN6G for stations within the U.S. and Canada. Please send SASE. Contact ***Ronald H. Kellerman DA1RO/KD4DNA, 435 TAW/WXF, PSC 5, Box 38 APO AE 09057.***

May 23–24

SUMTER, SC The Sumter ARA will hold its Iris Festival May 23 & 24 2000 UTC–2000 UTC. Station call: WA4UMU. Lower 10 kHz of General bands: 10m, 15m, 20m, & 40m. Lower 10 kHz of Novice/Tech. Band: 10m. Communication Mode: Voice only (all Bands)QSL Certificates available with SASE. Contact ***Sumter ARA, PO Box 193, Sumter, SC 29150-8862***

WATSON, IL The National Trail ARC will operate at the annual Memorial Day Homecoming. Effingham County. 28.4 +and lower General phone bands. For QSL, SASE. To Callbook: K9UXZ

May 28–31

GREENWOOD, NOVA SCOTIA The Greenwood ARC is operating the Special Event Station VE1RCAF Jan. 1–Dec. 31, 1992 to celebrate the 50th Anniversary of Canadian Forces Base. For commemorative QSL (and possible certificate) send QSL and SASE (CDN) or SA envelope and IRCs to ***Greenwood ARC, PO Box 63, Greenwood Nova Scotia, Canada, BOP INO.*** QSLs sent via Bureau will receive QSL card only via Bureau.

June 1–7

PADUCAH, KY The Paducah ARA will operate W4NJA/KY200 to commemorate the Commonwealth of Kentucky Bicentenial Celebration. CW and Phone, 25 khz from bottom of General/Novice bands. for special QSL, send SASE to ***KC4ENA, PO Box 1732, Paducah KY 42002-1732.***

June 6

GUELPH, ONT. CANADA CENTRAL ONTARIO AR FLEA MARKET will be held at Bingeman Park, Kitchener Ontario Canada. Contact ***Ray Jennings VE3CZE, 61 Ottawa Cres. Guelph, Ont. Canada, N1E-2A4(519) 822-8342.***

June 6–7

SIOUX CITY, IA The Siouxland ARA will operate KØAAR from 1500Z–2100Z, to celebrate the 120th anniversary of the 1500 mile steamboat race between The Nelle Peck and The Far West. Phone 7.243, 14.255, 21.355, 28.355. For Certificate send SASE to ***KØARR, 3407 Jennings St., Sioux City IA 51104.***

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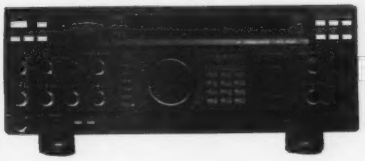

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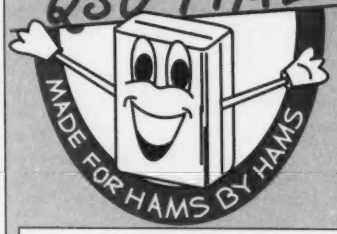

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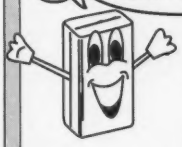

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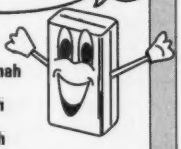

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PUFF, a Microwave Design Program

Last month I described components for use with microwave circuitry. I wanted to describe the special chip capacitors and resistors needed for low-loss conversion at microwave levels to help you select components that won't hinder you at microwave frequencies. I covered examples of non-microwave capacitors and described how to recognize them. This month I want to do a short recap of this information and then go on to a new topic: PUFF, the microwave design program from Cal Tech.

The capacitors needed to achieve high performance at the 5.6 GHz and 10 GHz microwave frequencies are those that are supplied from ATC (American Technical Ceramics), style ATC-100; Johanson, type S-910; and Dielectric Laboratories C11 series capacitors. These chip capacitors are sized for microwave strip line construction and have very low equivalent series resistance (ESR), making them suitable for microwave operation. There are other companies that manufacture chip capacitors that are quite good. I will provide information on them as soon as I receive the data sheets.

PUFF

So much for the capacitors. Let's get started with PUFF. This program is made for microwave circuit analysis and I hope you had time to order your copy and try it out. I am quite excited about PUFF because it allows you to construct microwave circuits. It is not just limited to amplifier construction; filters, patch antennas and many other two- or four-port devices can be constructed in strip line format. In the past I had to rely on published microwave circuitry from other designers, and I had to use the devices they selected. With PUFF, all that changed. Now I can design for devices I have on hand, modifying the circuit to my requirements. I can't overstate my excitement over PUFF's ability to re-design circuitry to suit whatever GaAsFET you might have on hand. All you need is the "S" parameters to pull the design off. This makes PUFF a very powerful engineering tool to have on hand. Let's cover some of the beginning steps required to design an amplifier from scratch. In actual use, the projected performance of my projects matched well with actual measurements, giving PUFF a five-star rating in my book.

If you want an amplifier to put in PUFF, use the test example shown in Figure 5. It gave 14 dB gain at 10 GHz. This amplifier needs some more work to improve the input return loss (s11). See what you can do with it as it has all the parts in "F4" to get you started.

Kerry N6IZW did the original work using PUFF, and I did the reproduction "silk-screening" of the printed circuit boards directly from PUFF's artwork printer dump. (We used a laser printer for high quality.) The circuit we designed was for a 10 GHz amplifier using an NEC-04583 GaAsFET. We selected this device for purely amateur reasons: They were available in surplus for modest prices and we had a few already on hand. Normally this device is quite costly, being space-certified, but being a discontinued device made surplus a good choice. A modest surplus quantity still exists and I will make them available while the supply holds out for under $10 per device. I also have some of the finished PC boards if you do not want to construct your own. Please note: You do not need to use the NE04583 device. You can use whatever device you have on hand as long as you have the S parameters for that particular device. You can design your own circuit using the samples I provide for a guide.

Starting PUFF requires an IBM or compatible computer with 640 kilobytes of memory and DOS-3.0 or later. Monitors supported are CGA, EGA, and VGA. Both Kerry and I had difficulty using the EGA drivers in PUFF, but the other modes worked great on the many different types of systems that we tried.

We had difficulty using 386 33 MHz computers. The program is loaded by typing PUFF at the DOS prompt. This will load the EXE file and bring up the setup.puf file to demonstrate some of the capabilities of the design program.

In actual use, save the master setup.puf file and do not alter it. On a saved copy of this file you will need to use your word processor to make the necessary changes required for your particular circuit configuration. This includes the type of device you are using and all parameters needed for this particular design, board size, dielectric used, etc. Note: The original setup.puf file uses a PC board dielectric of "10" for ceramic substrate. Most designs we use require this to be changed to "2.5" to reflect TEFLON. I suggest you look at Figure 1, "Original Setup.puf" and Figure 2, a modified file for a 10 GHz amplifier using 2.5 dielectric PC board material. Kerry renamed the file something we would remember easily for this particular type of device, in this case the new setup.puf file is NE04583U.PUF. Comments in the set-up file can be inserted behind the braces, as shown in Figure 1 or 2.

```
\b{oard} {.puf file for PUFF, version 2.0}
d      0     {display: 0 VGA or PUFF chooses, 1 EGA, 2 CGA,
3 One-color}
o      1     {artwork output format,0 dot-matrix, 1
LaserJet, 2 HPGL file}
t      0     {type: 0 for microstrip, 1 for stripline, 2 for
Manhattan}
zd    50.000  Ohms {normalizing impedance. 0<zd}
fd     5.000 GHz   {design frequency. 0<fd}
er    10.200       {dielectric constant. er>0}
h      1.270 mm    {dielectric thickness. h>0}
s     25.400 mm    {circuit-board side length. s>0}
c     19.000 mm    {connector separation. c>=0}
r      0.200 mm    {circuit resolution, r>0, use Um for
micrometers}
a      0.000 mm    {artwork width correction.}
mt     0.010 mm    {metal thickness, use Um for micrometers.}
sr     0.000 Um    {metal surface roughness, use Um for
micrometers.}
lt     0.0E+0000   {dielectric loss tangent.}
cd     5.8E+0007   {conductivity of metal in mhos/meter.}
p      5.000       {photographic reduction ratio.
p<=203.2mm/s}
m      0.600       {mitering fraction.  0<=m<1}
\k{ey for plot window}
du  0    {upper dB-axis limit}
dl  -20   {lower dB-axis limit}
fl  0    {lower frequency limit. fl>=0}
fu  10    {upper frequency limit. fu>fl}
pts 21    {number of points, positive integer}
sr 1    {Smith-chart radius. sr>0}
S   11    {subscripts must be 1, 2, 3, or 4}
\p{arts window} {O = Ohms, D = degrees, U = micro,
|=parallel}
lumped 150O
tline 50O 90D
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device fhx04
clines 60O 40O 90D
{Blank at Part h }
{Blank at Part i }
{Blank at Part j }
{Blank at Part k }
{Blank at Part l }
{Blank at Part m }
{Blank at Part n }
```

Figure 1. Original setup.puf.

The one critical point to make is the file extension ".PUF": Do not change this extension, for that is how the program finds your particular application set-up file. Another part of this set-up file contains "DEVICE FILE." This is the file that you load all the S parameters into for the particular device you plan to work with. This file must reflect accurately the S parameters for each device you plan to work with. They must cover the frequency range you call up in your setup.puf file or the program will halt. You will need one device file for each different device you have and a set-up file particular to each device/frequency that you plan to work with. All this information is necessary and must conform strictly to these rules.

The device file can be used by any set-up file calling for the same type device if the S parameters are called out for the frequency range in question in the device file. PUFF will pick out just the necessary frequency parameters you call out. For the NEC-04583, I called out S parameters in my device file from 0.1 GHz to 18 GHz. This requires a lot of typing, but it's worth it later. You can develop these files in a sort of library for later reference, making design very fast.

This file must be edited from the master .DEV file on the PUFF disk. DO NOT put any extra characters in the file; preserve it as a pure ASCII file. See Figure 3, my file for the NEC04583 S parameters from 0.1 GHz to 18 GHz. You can limit the frequency range by including only the frequency you need for calculations, but as I said, if other frequency use is contemplated it's best to have it all in the file. Once you get the hang of PUFF's format it will become quite easy to design a project. Most construction projects take only about a half hour, with most of the time used to modify the set-up file to suit your new requirements.

Let's get into some of the different parts of the PUFF screen. When you pull up the program you get four basic parts of the screen you can access. They are the Layout (F1), Plot (F2), Parts (F3), and the Board (F4). Each of these screen areas can be reached by typing the respective "F" control key on your keyboard. Typing "F10" at any time will bring up a small help function screen defining those commands particular to the portion of the screen you are currently residing in, such as "F4." To get the other help screens you must go to that screen, such as "F2," and re-type "F10" to get its help screen. Don't worry about all the commands in PUFF; just use "F10" for help, or post a lookup table from Figure 4.

Using the Program

Getting started in PUFF once your setup and device files are taken care of

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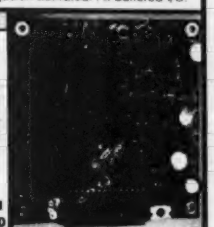

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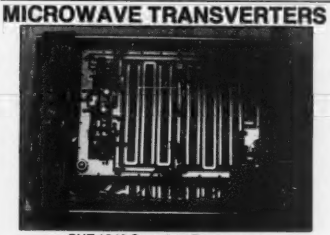

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```
\b{oard} {.puf file for PUFF, version 2.0}
d      0      {display: 0 VGA or PUFF chooses, 1 EGA, 2 CGA,
3 One-color}
o      0      {artwork output format:0 dot-matrix, 1
LaserJet, 2 HPGL file}
t      0      {type: 0 for microstrip, 1 for stripline, 2 for
Manhattan}
zd    50.000  Ohms {normalizing impedance. 0<zd}
fd    10.300 GHz   {design frequency. 0<fd}
er     2.500       {dielectric constant. er>0}
h      0.711 mm    {dielectric thickness. h>0}
s     33.000 mm    {circuit-board side length. s>0}
c      0.000 mm    {connector separation. c>=0}
r      0.200 mm    {circuit resolution, r>0, use Um for
micrometers}
a      0.000 mm    {artwork width correction.}
mt     0.010 mm    {metal thickness, use Um for micrometers.}
sr     0.000 Um    {metal surface roughness, use Um for
micrometers.}
lt     0.0E+0000   {dielectric loss tangent.}
cd     5.8E+0007   {conductivity of metal in mhos/meter.}
p      1.000       {photographic reduction ratio.
p<=203.2mm/s}
m      0.600       {mitering fraction.  0<=m<1}
\k{ey for plot window}
du   20    {upper dB-axis limit}
dl   -20    {lower dB-axis limit}
fl   9.0    {lower frequency limit. fl>=0}
fu   12    {upper frequency limit. fu>fl}
pts 21    {number of points, positive integer}
sr 1    {Smith-chart radius. sr>0}
S    21    {subscripts must be 1, 2, 3, or 4}
S    11
\p{arts window} {O = Ohms, D = degrees, U = micro,
|=parallel}
lumped 150O
tline 50O 28D
qline 50O 65D
tline 50O 40D
qline 50O 66D
qline 50O 90D
tline 50O 60D
device ne04583 3mm
tline 140O 90D
lumped 100O 2mm
tline 100O 50D
lumped 0O 1mm
tline 100O 50D
```

Figure 2. Modified setup.puf, renamed NE 4583U.puf.

in your word processor is easy. When calling up the PUFF program, I suggest you start by typing "PUFF." This will bring up the default setup.puf file. Then go to the plot window "F2" and type a "Ctrl-R." This is the read file command and you can then specify the set-up file you want to use, like "NE4583U." The extension ".PUF" is not needed as PUFF keeps track of the extension. Once your new file is loaded, verify that you have a few parts in the "F3" parts area. At minimum, you need a "tline" and a device to get started. Type the information in; you can use the examples in Figure 1 or 2 for reference. Others can be added in the same format whenever you require them by accessing that portion of the screen: "F3," etc. Now go to the layout screen "F1" and you will see an "X" in the center of the screen if all is ok. If not, type a "Ctrl-E" to erase the circuit, then start over.

Usually we place the device at the center of the circuit. To place the device, look in the parts window and see which line you have the device specified on (let's say line d). Type that line letter, "d," and a device will appear at the center of the screen when you specify the direction you want the device to face. To face right, hit the right arrow key and the device will appear on the screen. Then move to the input of the device and hit the left arrow key. Now let's lay the first transmission line (strip line) going towards port 1, the input of the amplifier. Type the letter of your "tline" in the parts window (let's assume "b"), then type the letter "b" and the direction you want this strip line to go, and hit the left arrow key once.

This places the input strip line from the amplifier going towards the input connector of the board on the left. To connect the strip line to the connector, hit the number key "1." This will make an electrical connection to the input port between the strip line and the port 1. Use the right arrow key three times to go to the output of the amplifier. Now, to connect the output of the amplifier to port 2 for analysis (of the input network), hit the number "2" key. The circuit now goes from the input of the amplifier to the output and can be analyzed using the plot window.

Access the PLOT window by hitting the "F2" key. We can now set up the parameters for the plot analysis. All parts of the plot window, as well as the graph, can be changed to accommodate the type of plot you want to make.

Normally, we first start out making a plot of the input match of the network, the "tline" on line "b" of the parts file. The parameter we want here is "S11," input return loss or impedance matching at your desired frequency. To do this, go to the parts window "F3" and place a question mark in front of the electrical degree specified for the part you want to sweep. (Example: "b tline 50 ohms ?100 degrees.") Don't worry about the ohm symbol or the degrees symbol; they don't appear on my word processor, but they are taken care of in PUFF. To get a degrees symbol hit "Alt-D" and to get the ohms symbol hit "Alt-O"; the parallel sign is "Alt-P" and micro is "Alt-M." To get a big Smith chart using VGA monitors only, type "Alt-S." PUFF keeps symbols simple—if you forget type "F10" to bring up the help screen.

```
{NE04583 MES FET   Vds=3V, Ids=10mA)
   f        s11              s21              s12              s22
  0.1    0.999     -2.0    2.875   178.0    0.002    88.0    0.742    -1.0
  1.0    0.990    -18.0    2.794   162.4    0.016    78.0    0.729    -13.0
  2.0    0.970    -36.0    2.772   145.0    0.033    64.0    0.717    -27.0
  3.0    0.947    -54.0    2.716   128.0    0.046    49.0    0.706    -40.0
  4.0    0.915    -71.0    2.565   111.0    0.060    37.0    0.681    -53.0
  5.0    0.882    -87.0    2.534    95.0    0.069    26.0    0.669    -64.0
  6.0    0.854   -104.0    2.325    80.0    0.075    15.0    0.663    -76.0
  7.0    0.825   -120.0    2.100    65.0    0.080     5.0    0.650    -89.0
  8.0    0.790   -135.0    1.802    50.0    0.084    -6.0    0.643   -101.0
  9.0    0.775   -149.0    1.775    38.0    0.086   -12.0    0.643   -111.0
 10.0    0.755   -162.0    1.650    26.0    0.088   -19.0    0.629   -122.0
 11.0    0.774   -175.0    1.555    13.0    0.091   -26.0    0.631   -132.0
 12.0    0.725    171.0    1.455    -3.0    0.094   -33.0    0.640   -142.0
 13.0    0.705    159.0    1.350   -15.0    0.097   -37.0    0.642   -152.0
 14.0    0.688    149.0    1.250   -26.0    0.100   -43.0    0.645   -163.0
 15.0    0.680    142.0    1.200   -38.0    0.102   -45.0    0.654   -172.0
 16.0    0.675    128.0    1.101   -50.0    0.105   -48.0    0.673   -178.0
 17.0    0.652    117.0    1.051   -61.0    0.108   -50.0    0.687    170.0
 18.0    0.630    107.0    1.012   -73.0    0.115   -54.0    0.696    160.0
```

Figure 3. NEC-04583 device file, 0.1GHz/18 GHz.

What you want to record is the crossing point of the sweep on the "g=1" circle. To find out what this point is, move the marker with the "page up" or "page down" keys to enter the exact spot it crosses the upper part of the "g=1" circle. If it is not precise use more points of calculation and plot it again. When this value is noted, go back to the parts window "F3" and remove the "?" on the part and change its electrical degrees to that noted in the step just completed. Now establish another "tline" and set the value to any reasonable value, say, 50 degrees, and place the "?" in front of its part to sweep it. When this is done, go to the board window "F1" and position the marker on the left end of the "b" part. Erase the connection to the number 1 port by holding down the shift key and hit the number 1 key. After the connection has been erased type the new part "tline" letter, say, "c," and hit the down arrow. This should place a new matching "tline" on the left end of the "b" part. Reconnect port 1 by arrowing up one keystroke up-arrow, and type the number "1" to make the left circuit connection.

Now go back to the plot window "F2" and re-plot "S11" to determine the matching stub's proper value. If the "tline" strip is proper in length from the previous sweep, the new sweep should circle the "g=1" circle perfectly. Use decimal points to be exact to one or two places. You should obtain a good graph plot of high return loss "dip" in the chart at the frequency you desire to operate at. Use the page up and down keys to determine just where the crossing point is.

Some of the control characters are the photographic artwork, "Ctrl-A"; erase and start over, "Ctrl-E"; move to nearest node (can be very useful), "Ctrl-N"; re-plot, "Ctrl-P"; read file, "Ctrl-R"; and save file, "Ctrl-S," needless to say the most important of all commands to remember.

Well, so much for PUFF for this month. I hope you have as much fun as I have had. Next month I will cover some fine points on PUFF operation. I have a few NE04583 devices available, as well as a PC board using the NE04583 device, with gain of about 12 dB for one stage. The price of one device and PC board is $20 postpaid, or $10 each for either item postpaid. Save money and design your own with PUFF. As always, I will be glad to answer any questions covering this month's topic, as well as related subjects. 73 from Chuck WB6IGP.

```
F1   LAYOUT HELP
ARROW KEYS      DRAW PART
=               GROUND
1 THRU 4        CONNECT PATH
a THRU r        SELECT PATH
CTRL-e          ERASE CKT
CTRL-n          GO TO NODE
SHIFT MOVE/ERASE

F2  PLOT HELP
ARROW KEYS      CURSOR
p,CTRL-p        PLOT
pgup<pgdn       MARKER
CTRL-s          SAVE
CTRL-a          ARTWORK
i,s             IMPULSE STEP
TAB             TOGGLE SMITH

F3   PARTS HELP
ARROW KEY       CURSOR
DEL,BACKSPACE,INS
ALT-o           OHMS SYMBOL
ALT-d           DEGREE SYMBOL
ALT-m           Mu SYMBOL
ALT-p           PARALLEL SYMBOL
CTRL-e          ERASE CKT
CTRL-r          READ FILE
TAB             EXTRA PARTS
```

Figure 4. PUFF Command summary.

HAMSATS

Amateur Radio Via Satellite

Andy MacAllister WA5ZIB
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More SAREX Activity Coming

The Shuttle Amateur Radio Experiment (SAREX) continues with more missions scheduled this year. Unlike the Russian *Mir* activity, U.S. shuttle operations use separate uplink and downlink frequencies. Current plans include 145.55 MHz as the primary downlink and 144.91, 144.95 and 144.97 MHz for uplinks.

Many shuttle crew members who are not yet hams are pursuing their licenses. The Johnson Space Center Amateur Radio Club and licensed astronauts have requested that SAREX equipment be carried on all high-inclination orbit missions. These flights provide more hams with the opportunity for earth-to-shuttle contacts. Starting with STS-50, a common callsign, W5RRR/S, will be used for shuttle missions to avoid confusion, especially for packet activity.

STS-50 is currently scheduled for launch on June 9th from Pad A at the Cape using vehicle 102, *Columbia*. Expected to last 13 days, this will be the longest orbiter flight to date. The inclination will be 28.5 degrees and the altitude 160 miles. The primary payload is USML-01, the U.S. Microgravity Laboratory. Richard "Dick" Richards is currently studying for his license and anticipates voice contacts on 2 meters, as with the STS-45 mission.

Late August is the anticipated liftoff of the *Endeavor* (vehicle 105) on a seven-day mission to 163 miles, with a 57-degree inclination orbit. This will be the second flight of the *Endeavor*. The primary payload is Science Lab "J" with 12 Get-Away-Special canisters (GAS-CAN's) in the payload bay. Jay Apt N5QWL is expected to operate both packet and voice.

Like earth-based stations, the shuttle crews run tracking programs to monitor anticipated coverage areas as they orbit the earth. The primary system includes a Grid laptop computer with a modified version of "GrafTrak II" and "Silicon Ephemeris" by Silicon Solutions of Houston, Texas. Versions of the software have been available to amateurs and commercial interests for several years. Joe Bijou WB5CCJ has recently updated the shuttle software and Gil Carman WA5NOM of NASA has provided prelaunch testing of the package. Ground stations typically use a feature of "GrafTrak" to sequence through specific satellites as they pass over. The shuttle-based version operates from the spacecraft point of view to sequence through cities within range rather than orbiting objects. Other modifications to the software provide better and more detailed information on mutual visibility possibilities between the orbiter and *Mir*.

More SAREX missions are in the early planning stages for 1993. Some may use the simplified voice-only equipment while others may have enhanced operations for packet, slow-scan and additional modes. A good source of information for SAREX operations is the Johnson Space Center NASA BBS at (713) 483–2500. To use the BBS, call at 1200 bps, eight data bits, no parity and one stop bit. When prompted for a "number," enter 62511. Although the data system will respond to 2400 bps, the actual BBS will not.

AMSAT Nets

As a supplement to the March 1992 column, which gave a comprehensive list of satellite operation resources, here is information about the AMSAT nets.

Table 1 is a list of the current North American AMSAT HF nets, thanks to AMSAT Net Manager Wray Dudley W8GQW/7. For many enthusiasts, these nets provide a sole source of updated satellite schedules and general news concerning the amateur satellite program.

The Sunday 15 meter net on 21280 kHz can also be heard on an AMSAT-OSCAR-13 downlink of 145.955 MHz (USB) when the satellite is within range of Arizona (home of W8GQW/7). AMSAT also sponsors operations nets via A-O-13 on 145.950 MHz. The schedule of these nets changes to favor the orientation of the satellite. A current schedule is always included as one of the news items covered in the HF nets.

Participation in the A-O-13 operations nets is always good and sometimes quite surprising. On a recent net, Stan WA4NFY checked in using an experimental antenna built to specifications for the satellite-based array for Phase-3-D. The prototype patch antenna for 70cm had a better signal into A-O-13 than his 40-element crossed yagi. AMSAT officers and satellite designers are often available on these nets to answer questions and provide updates on future projects.

Russian Hamsats to End?

The recent political changes in the Soviet Union have not left amateur radio unscathed. The connection between ham activity and the government is not the same as in the U.S. Amateur radio is more tightly controlled and the satellite efforts are sometimes directly funded and administered by the government. Cutbacks in this funding could end some current and future projects. Cash flow difficulties at the RS control station RS3A in Moscow have already resulted in staff cuts.

For several years the RS program with its Mode A transponders (2 meters up and 10 meters down) has been considered the best entry-level satellite activity. The RS satellites have provided the starting point for many hamsat chasers. Other satellite builders around the world have gone on to VHF, UHF and microwave designs for new satellites.

RS-15 was originally scheduled for launch in April. Its future is now in question. This satellite was to have a 2000-kilometer circular orbit, much higher than the current RS hamsats. Other satellite programs beyond RS-15 (six in all) are also affected and may be canceled.

Efforts to solve the current financial difficulties with the RS program are under way, but the needed aid may be too late to maintain the program. Let's hope not. 73

Table 1. Active North-American AMSAT HF Nets

Net	Day	Time	Frequency (kHz)
AMSAT East Coast	Tuesday	9 p.m. Eastern	3840
AMSAT Mid-America	Tuesday	9 p.m. Central	3840
AMSAT West Coast	Tuesday	9 p.m. Pacific	3840
AMSAT International	Sunday	1900 UTC	14282
AMSAT International	Sunday	1900 UTC	21280
AMSAT International	Sunday	2300 UTC	18155

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RTTY LOOP

Amateur Radio Teletype

Marc I. Leavey, M.D., WA3AJR
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Baltimore MD 21208

Over the past few years, I have described this column as dealing with all forms of digital communication, not just 5-level RTTY. This should be evident because of the frequent inclusion of AMTOR, packet, computers, and other more exotic digital modes in its content. Today we take a look at another digital mode, prompted by several letters from readers requesting programs to generate Morse code.

Morse code? Sure, why not. Morse is the ultimate digital mode, consisting of a single bit being turned on and off, albeit for varying lengths of time. Computers are ideally suited to the task of learning Morse, and such code generation is what many of you have asked for.

Interestingly, most of the requests have come in for a program for the Radio Shack Color Computer. This capable Motorola-6809-based computer was one of the first computers used by amateurs, and, interestingly enough, sported a multitasking multi-user operating system modeled on UNIX, OS9, long before Windows or OS/2 (notice the similarity?).

Anyway, I looked around on Delphi, and located two good programs. Published in the late *CLOAD* magazine, a magazine published on cassette for the Radio Shack Color Computer, some eleven years ago by a D. Rothstein, these two programs comprise an instruction module for Morse code. You can download them from the *73* BBS, under the file name CODE.ZIP.

For IBM PC clone users, the program listed here in the sidebar may be just what you're looking for. This is another older program (about nine years old), written by Elwood Downey WB0OEW. This BASICA program is straightforward enough to run in most

Continued on page 51

Morse Code Program for the IBM PC

```
10  ' Morse Code Practice Program. Elwood Downey, WB0OEW, August, 1983.
20  ' Written for the IBM PC in Microsoft Basica, V1.1, for PC-DOS V1.1.
30  ' This program may be freely used, traded or copied but the author's
40  ' name and this stipulation shall remain as comments and the program
50  ' shall never be sold for profit.
60  '
70  CLS
80  KEY OFF
90  '
100  ' select input source: either from a file, the keyboard or random.
101 PRINT:PRINT "   ALL entries are to be in LOWER case letters":PRINT
102 PRINT"    ENTER '!' TO START."
103 ZZZ$=INKEY$:IF ZZZ$="!" THEN 104 ELSE 103
104 CLS
110  INPUT "file name? (or 'random' or 'con:') ",F$
120  IF F$="random" THEN RANFILE=1 ELSE RANFILE=0
130  IF RANFILE=1 THEN RANDOMIZE VAL(RIGHT$(TIME$,2)): NCHRS=0:
     NGRPS=0
140  IF RANFILE=0 THEN OPEN F$ FOR INPUT AS #1
150  '
160  ' select speed
170  INPUT "wpm? ", WPM
180  '
190  ' initialize code strings
200  ' to add more characters, such as apostrophe, increase numcodes,
210  ' add code string and character at end of current lists and add case
220  ' to main loop, below.
230  NUMCODES = 41  ' . , / ? - plus 26 + 10
240  DIM CODES$(NUMCODES-1)
250  DIM CHARS$(NUMCODES-1)
260  FOR I=0 TO NUMCODES-1
270  READ CODES$(I)
280  NEXT
290 FOR I=0 TO NUMCODES-1
300  READ CHARS$(I)
310 NEXT
320 ' code strings. in one-to-one correspondence with characters, below.
330 DATA ".-", "-...", "-.-.", "-..", ".", "..-.", "--.", "...."
340 DATA "..", ".---", "-.-", ".-..", "--", "-."
350 DATA "---", ".--.", "--.-", ".-.", "...", "-"
360 DATA "..-", "...-", ".--", "-..-", "-.--", "--.."
370 DATA "-----", ".----", "..---", "...--", "....-", "....."
380 DATA "-....", "--...", "---..", "----.", "-----"
390 DATA ".-.-.-", "--..--", "..--..", ".----.", "-...-"
400 ' characters.
410 DATA "A", "B", "C", "D", "E", "F", "G", "H"
420 DATA "I", "J", "K", "L", "M"
430 DATA "N", "O", "P", "Q", "R", "S", "T"
440 DATA "U", "V", "W", "X", "Y", "Z"
450 DATA "0", "1", "2", "3", "4", "5"
460 DATA "6", "7", "8", "9"
470 DATA ".", ",", "/", "?", "-"
480 '
490 ' set up arrow keys to change speed and frequency.
500 PRINT
510 PRINT CHR$(24); " "; CHR$(25); " to raise or lower tone,   ";
520 PRINT CHR$(27); " "; CHR$(26); " for slower or faster code."
530 PRINT "Ctrl-Break to quit, F9 to pause."
540 PRINT
550 ON KEY(11) GOSUB 1040: KEY(11) ON
560 ON KEY(14) GOSUB 1050: KEY(14) ON
570 ON KEY(12) GOSUB 1090: KEY(12) ON
580 ON KEY(13) GOSUB 1080: KEY(13) ON
590 ON KEY(9) GOSUB 1330: KEY(9) ON
600 '
610 ' set defaults, init screen.
620 F = 600          ' initial tone frequency
630 SIL = 32767      ' special code for no tone
640 GOSUB 1120   ' calculate dit, dah and space lengths.
650 GOSUB 1180   ' display wpm and freq
660 '
670 ' define character type checking functions
680 DEF FNLOWER(C$) = "a"=C$ AND C$="z"
690 DEF FNUPPER(C$) = "A"=C$ AND C$="Z"
700 DEF FNDIGIT(C$) = "0"=C$ AND C$="9"
710 '
720 ' main loop. read (or generate) each character, sound it and print it.
730  IF RANFILE THEN GOSUB 1240: GOSUB 900: PRINT CHARS$(MORSE);:
     GOTO 870
740 C$ = INPUT$(1,#1)
750 IF " "=C$ OR C$=CHR$(13) THEN GOSUB 990: GOTO 860
760 IF "."=C$ THEN MORSE=36: GOTO 850  ' morse - codes$ array index
770 IF ","=C$ THEN MORSE=37: GOTO 850
780 IF "/"=C$ THEN MORSE=38: GOTO 850
790 IF "?"=C$ THEN MORSE=39: GOTO 850
800 IF "-"=C$ THEN MORSE=40: GOTO 850
810 IF FNLOWER(C$) THEN C$ = CHR$(ASC(C$)-32)
820 IF FNUPPER(C$) THEN MORSE=ASC(C$)-ASC("A"):  GOTO 850
830 IF FNDIGIT(C$) THEN MORSE=ASC(C$)-ASC("0")+26: GOTO 850
840 GOTO 870
850 GOSUB 900
860 PRINT C$;
870 GOTO 730
880 '
890 ' sound dit for each ".", dah for each "-" in string codes$(morse)
900 FOR I=1 TO LEN(CODES$(MORSE))
910  IF MID$(CODES$(MORSE),I,1) = "." THEN GOSUB 1000 ELSE GOSUB
     1010
920 NEXT
930 GOSUB 980
940 RETURN
950 '
960 ' produce elemental sounds, or silences.
970 SOUND SIL,DIT: RETURN    ' element space
980 SOUND SIL,ELE*2: RETURN   ' character space, allow for previous trailing
990 SOUND SIL,ELE*6: RETURN   ' word space, allow for trailing.
1000 SOUND F,DIT: GOSUB 970: RETURN      ' dit
1010 SOUND F,DAH: GOSUB 970: RETURN      ' dah
1020 '
1030 ' change frequency of tone
1040 F = F*1.104: GOSUB 1180: RETURN
1050 F = F/1.104: GOSUB 1180: RETURN
1060 '
1070 ' change speed; update element timings.
1080 WPM = WPM+1: GOSUB 1120: GOSUB 1180: RETURN
1090 WPM = WPM-1: GOSUB 1120: GOSUB 1180: RETURN
1100 '
1110 ' calculate element timings. units are clock ticks, which are at 18.2hz.
1120 IF WPM13 THEN CWPM=13 ELSE CWPM=WPM
1130 DIT = 21.84/CWPM: DAH = 3*DIT
```

(Program continued on page65)

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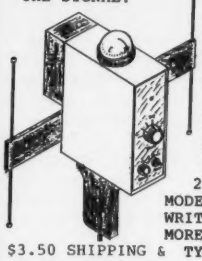

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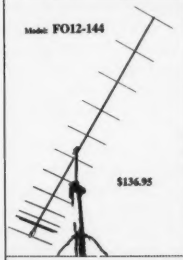

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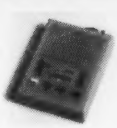

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Notes from FN42

This month we are lucky to have a language lesson compliments of David Cowhig WA1LBP. David says that he is moving in May to Japan and will be gone for two years. He has requested a copy of the 73 universal reciprocal licensing form, so it appears that he wishes to remain active on the bands.

As I am writing this it is the first of March. Part of the correspondence that has arrived during the month of February is a press release from the International Telecommunication Union (ITU) written and released on 21 January, 1992. It speaks of the World Administrative Radio Conference (WARC 92). Its information is too old to make any sense in May, but one thing that caught my eye is that the conference ends on the 3rd of March, just two days away. I wonder what good things and bad things have fallen on the international ham community. Have we gained or lost in our quest for frequencies for our hobby? Oh, to have been a member of the team; but, like you, I will have to wait for more press releases to find out what happened.

I almost forgot: For the hams in the New England area of the United States, May 2nd is the date, and the location is the Fairgrounds at Deerfield, New Hampshire, for the 1992 Spring Edition of Hoss Traders. And don't forget, the gates open at 4 p.m. on Friday and overnight camping is acceptable. The proceeds go to the Shriner Burn Hospital in Boston. See you there, I hope!—Arnie, N1BAC

Roundup

Japan From the *JARL News*:
Radio Stations Exceed 7 Million

The Ministry of Posts and Telecommunications of Japan reported on November 21, 1991, that the present number of radio stations in Japan as of the end of September 1991 reached 7,027,215, which is an increase from the previous year.

Amateur radio stations numbered 1,154,142, which made it the third largest group, accounting for 16.4% of the stations. The largest group is the land mobile stations, with 3,039,034; and the second largest group is the personal radio stations, with 2,446,840.

The group of land mobile stations has recently been increasing at a remarkable rate, as high as 37 percent per year. And as a result, its share of all the stations has been growing annually.

All-Japan ARDF Competition

The '92 All-Japan ARDF Competition will be held in the Nan-Shin area of Nagano Prefecture on November 1st of this year.

Competitors will be selected from participants of the '91 All-Japan ARDF Competition and also from participants of local ARDF Competitions held on or after October 21, 1991.

Japanese Language Lesson: More than one million hams call Japan their QTH. As Cycle 22 solar activity continues to increase *[Or decrease, as the case may be.—Arnie]*, we'll have more and more opportunities to work JAs. Japanese hams study books such as *English for Ham QSO* by JA1ANG and *Conversational American English for Ham Radio* by Roy Waite W9PQN in order to improve their English. We U.S. hams, however, have no book to teach us the Japanese we need to get through a simple QSO with a Japanese amateur in Japanese. Japanese hams rarely enjoy the luxury of working DX (like us!) in their own language. Not quite fair, is it? We can't expect people around the world to speak to us in English forever.

> ***"We can't expect people around the world to speak to us in English forever."***

Here I'll present a few Japanese phrases you can try on your next JA contact. They should get a big kick out of it. The JA stations I contact get a bit of a shock when I come back to them in Japanese!

First, a few comments on Japanese pronunciation. Although the Japanese writing system, which uses Chinese characters and two 51-symbol syllabaries, and the grammar are difficult, Japanese pronunciation is very easy. Place equal stress on each syllable. Not Toyota but To-yo-ta. Not Yaesu but Ya-e-su. I mark long vowel sounds by doubling the vowel. My transcription is essentially the Hepburn system, a system used internationally for writing Japanese using the Roman alphabet. My main departure from the Hepburn system is adding dashes between syllables. Where the Hepburn spelling might be misleading, I have placed a close English equivalent in brackets. Remember, equal stress on each syllable is the key.

O-hi-o go-zai-ma-su. Good morning [Pronounce o-hi-o like the state of Ohio. It's morning in Japan when we work them in the evening.]

Wa-ta-ku-shi no QTH wa [ba-ji-ni-a shu] de-su. My QTH is the [state of Virginia].

Re[ley]-por-to wa five-nine. Your report is 59 [I often hear Japanese hams giving reports to each other (using English!!) in this way so you do the same.]

Wa-ta-ku-shi no QTH wa [a-mer-ri-ka no shu-to Washington DC] ka-ra ju-ni ki-ro-mee[may]-to-ru ku-rai no to-ko-ro de-su. My QTH is about 12 kilometers from [the U.S. capital, Washington DC., so they won't confuse DC with Washington state].

Wa-ta-ku-shi wa Mt. Vernon a-ma-chya mu-sen ku-ra-bu no mem-ba de-su. I am a member of the Mt. Vernon ARC.

Na-mae wa David de-su. My name is David. [If the Japanese operator gives his name as Tomo, refer to him as To-mo-san. Do not put -san after your own name.]

[To-mo]-san no ei-go wa tae-hen hoo-zu de-su ne. Your [Tomo's] English is very good.

Ni-hon-go de nan te i-ma-su-ka. How do you say that in Japanese?

If you have a solid contact, you might ask the Japanese operator how to say some phrases in Japanese. You can thank him by saying:

[To-mo]-san wa tai-hen ii ni-hon-go no sen-sei de-su. You [Tomo] are a very good Japanese teacher.

To-te-mo ta-no-shi QSO o doo-mo a-ri-ga-to-go-zai-ma-shi-ta. Thank you for a very enjoyable QSO.

Ma-ta doo-zo yo-ro-shi-ku o ne-gai shi-ma-su. Please give me a call another time.

Try some of these phrases on your next contact with JA. It should get you out of the carbon copy QSO rut. Give a JA operator a good laugh and improve your Japanese at the same time!

If you would like to learn to speak simple conversational Japanese fairly quickly, consider *Japanese for Beginners*, published by Gakken. You can purchase it with two cassette tapes. This book takes you through the essentials of Japanese grammar and builds up to a 1,200 work vocabulary in 180 (small) pages. Not a large vocabulary, but considerably larger than the English vocabulary of many of the DX stations you are working now. Have fun!

73 de David Cowhig, WA1LBP

[What you have seen is the first in a series from David to "Ye Old Rf Output," newsletter of the Mt. Vernon ARC. If you have any comments for David you had better hurry because he is leaving in May for two years in Japan. His address is: 6317 May Blvd., Alexandria VA 22310. Or send him a packet message to WA1LBP @ N4QQ.MD.USA.—Arnie]

Scotland *Information from "Paddy" McGill GM3MTH*: The Scottish Tourist Board (Radio Amateur) Expedition Group, STB(RA)EG, would like to announce its awards program for 1992. The purpose of this group is: (a) To set up worldwide Communications Stations in Scotland that are Unique, Scenic, Cultural, Historic or in any other way relating to Scotland; (b) To make the Public more aware of the Hobby of Amateur Radio through a Public Relations display at each event. All events are open to the Public.

The THISTLE AWARD and The SUPREME TARTAN BANNER AWARD are issued by the Group on a continuous basis. Both awards are in colour. Claims for ALL Scottish Tourist Board Awards should be sent to: Awards Manager (Robbie GM4UQG), PO Box 59, Hamilton, Scotland ML3 6QB.

The events for this year are: (1) Scottish Activity Weekend—3rd weekend in April each year; (2) Castles on the Air; (3) Eight Nations National Trust Event; and (4) International St. Andrews Day. The planned frequencies are (±): C.W. 3510, 7010, 10140, 14010, 21010, 24905, 28010 MHz; SSB 3765, 7065, 14140 & 14240, 18130, 21250, 24950, 28400 to 28600 MHz. The times of the events are normally Saturdays, 0800 to 2200 UTC, and Sundays, 0900 to approximately 1500 UTC. Times are subject to change.

If you wish a list of events/information package, it is available from: John "Paddy" McGill GM4MTH, 9, Ramsay Pl., Coatbridge, Lanarkshire, Scotland, ML5 5RE. Please send two second class stamps or equivalent for return postage. Tel: (0236) 440495; FAX: 0236434194; International: +44236434194.

The following is a quick list of events through May: April 11th, GB2SMC, Scottish Museum of Communication, Grand Opening in Bo'ness; April 18/19, GB2STB, 1st Annual Scottish Activity Weekend, 12 Scottish Regional Stations, Clubs, and individual stations, Certificate & Trophies; May 16/17, GB400CA, Crathes Castle 400th Anniversary, 2nd Annual Castles on the Air, nine castles in UK and Ireland, Certificate. *[I will put the Certificate and Trophy Information on the 73 BBS in the "73 International" area. I remember that several years ago the STB(RA)EG operated from some of the distilleries. Why not this year? I guess I will have to write Paddy and find out.—Arnie]*

U.S.A. *From the International Mission Radio Association (IRMA) Newsletter*: IRMA has been developed to provide transfer of traffic for missioners of all denominations and for other volunteer services. Their traffic handling net operates Monday through Saturday, from 1900–2000 GMT (Daylight Saving Time 1800–1900 GMT) on 14.280 MHz. If you would like to receive more information, join IRMA, or receive their newsletter, contact: IRMA Newsletter Editor, Rev. Michael Mullen, C.M. WA2KUX, St. John's University, Jamaica, NY, USA 11439.

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446MHz 7.2dB
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Max Power: 200 watts
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7/8 wave
446MHz 7.6dB
5/8 wave x 3
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146MHz 3.5dB
1/2 wave
446MHz 6.0dB
5/8 wave x 2
Max Power: 120 watts
Length: 3' 2"
Connector:
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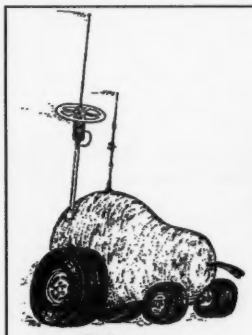

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No Code—One Year Later

As I write this, we have just passed the first anniversary of the codeless Technician class license. We've had a full year to take a good, hard look at this controversial (to some) rule change. From everything I've heard and seen, I think we can declare the no-code license an overwhelming success. No matter how hard a small but vocal minority tries to put it down (stilll), the dropping of the code requirement for VHF and above licenses has had nothing but positive influence on amateur radio.

And yet, that small minority of fuddy-duddies still can't get it through their crusty craniums that the future of amateur radio has nothing to do with this particularly outdated mode of communications.

Just last week, I got into yet another drawn-out conversation with a middle-aged ham who was predicting the downfall of amateur radio (not that all hams who oppose the no-code license are middle-aged—some of them are really old). He used all of those "intelligent" arguments that we've all heard a thousand times: The bands will be full of unqualified riff-raff (unlike the qualified riff-raff we now find ourselves stocked with). The ham bands will be full of all them good-buddy CBers (without exception, every former CBer I've ever met—on the air or in person—has been a credit to this hobby). It's dangerous to let unqualified (there's that word again) people muck around with potentially dangerous electronic equipment (I've yet to hear a good answer when I ask how a knowledge of Morse code makes someone qualified to work on electronic circuits). Two meters will be filled to the brim with these codeless Techs (I sure wish that were true, but alas, 2 meters seems to be just as barren of activity in most of the country as before). I had to learn the code, so everyone else should, too (this comment doesn't even deserve a reply). Morse code is an amateur radio tradition that should be maintained (sure, just like spark gaps, tubes and 2 meter AM).

Not content at letting the technological advances of the last 30 years shoot by them, these curmudgeons have actually pestered the FCC with numerous requests to either amend or reverse the no-code ruling. If they couldn't get the no-code Techs thrown out, they at least want to saddle them with a distinctive callsign. I imagine that this is so they can identify and avoid talking with no-code Techs (no great loss for the Techs). Gee, I wonder what the opinion of the FCC was of having to spend the time and resources to deal with these complaints and petitions? I wonder if the actions of these crybabies did anything to improve the FCC's already low opinion of amateur radio operators?

Allow me to share with you a few of my observations of the effect of the codeless Technician license. I have met hundreds of these newly licensed hams over the past year. I've talked to them on the air. I've met them face-to-face at hamfests. I've received their letters and phone calls.

1. I've noticed that there are a lot of younger faces entering amateur radio via the codeless Technician class license.

2. I've noticed a lot more women with newly acquired callsigns.

3. I've seen auditoriums from Florida to California packed with youngsters at Youth Forums.

4. Every new Technician I've met—every single one—has told me that they are currently studying the code so they can get on HF.

5. I've received letters from amateur radio clubs across the country who can't get their license classes going fast and frequently enough to satisfy the demand—and that includes code classes and upgrade classes.

6. I've seen attendance records made at almost every hamfest I've attended this year.

7. I've seen the amateur radio business community increase sales during the worst recession since the 1930s.

So, would somebody kindly explain to me what the problem is?

One other benefit I've noticed is that there is a lot more "elmering" going on these days. I hear experienced hams kindly counseling a frightened newcomer on proper repeater procedures. I've heard people offering their help to newcomers on every repeater I've checked into. Help with antennas... loans and repair of old gear... rules clarification... invitations to club meetings. All over the country, I've heard experienced hams reach out to these newcomers with understanding and patience. They have obviously found out something that has always been true—you get an incredible amount of personal satisfaction from helping newcomers.

To be sure, I've also heard newcomers chased off of repeaters. I've received letters from clubs that voted to keep out codeless Techs (gee, I wish I could hang out with those guys). I've seen hams who wouldn't know a transistor from a tuna sandwich telling electrical engineers and computer programmers that they aren't qualified to be hams because they didn't pass a code test. I've even seen anti-Technician writings in amateur publications (though none that are important enough to make any difference). Thankfully, these types of episodes have been few.

If there has been a negative side to the codeless Technician license, I've yet to see it. Thousands of enthusiastic and motivated newcomers are good for any hobby—especially a hobby that is currently searching for new justifications for its existence.

As for those few who continue to complain about the passing of Morse code—don't fret. It's only a matter of time before we are picking over their stations at a local flea market and see them listed as Silent Keys.

PROPAGATION

Jim Gray W1XU

Jim Gray W1XU
P.O. Box 1079
Payson AZ 85541

Conditions this month are expected to be fairly quiet on the HF bands... with little magnetic field disturbance, reflected by generally low "A" indexes and solar flux indexes. The 10 cm flux is likely to be below the March and April values, and DX conditions will therefore not be quite as good as during the spring months.

You can expect generally Good conditions, however, with considerable DX activity on 10 and 12 meters, peaking in the afternoon, and usually favoring transequatorial paths. Short skip will also abound between 500 and 1,000 miles or so. On 15, 17, and 20 meters, worldwide DX should be available most days between dawn and sunset, again peaking in the afternoon. Short skip out to about 2,000 miles will prevail on most days.

On 30 and 40 meter bands, DX should be good during hours of darkness until after dawn. Short skip to 1,000 miles during the day, and to 2,000 miles at night should be workable on most days and nights.

On 80 meters, DX to various parts of the world should be workable on some days of the month—particularly during nighttime and early morning hours—when the bands are quiet and noise levels are low. Daytime short skip will also be available, but late spring and early summer conditions on 80 meters during the day are not generally considered to be particularly favorable—often due to thunderstorm activity and high levels of static.

The sunspot cycle continues its inevitable slow decline this year, and soon we shall begin to notice dropout of the higher HF bands and lack of quality "solid" signals on many days of the month. WWV continues to be your best source of current information each day, so check at 18 minutes after any hour for the readings of "A"/"B" magnetic field indexes and Solar Flux Index. Also, keep a sharp lookout for SID (Sudden Ionospheric Disturbance) reports this month via WWV.

VHF activity on 6 meters and above can be very good this month, so check the 6 and 2 meter bands frequently for "tropo" and sporadic E-layer activity.

Consult the accompanying charts for a preview of likely Good and Fair conditions on the HF bands.

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	10	—	20	—	—	—	20	20	—	—	15	10/15
ARGENTINA	15	15/20	20	40	40	—	—	10	—	—	10/15	10/15
AUSTRALIA	10/15	20	20	20	20	40	20/40	20	—	—	—	10/15
CANAL ZONE	15	20/40	20/40	20/40	20/40	15	15	10	10	10	20	10
ENGLAND	20	40	40/80	40/80	40	—	—	15	10	15	15	20
HAWAII	10/15	15	20	20	20/40	20/40	20	20	—	—	—	10/15
INDIA	20	20	—	—	—	—	—	15	—	—	—	—
JAPAN	10	—	20	—	—	—	20	20	—	—	15	10/15
MEXICO	15	20/40	20/40	20/40	20/40	15	15	10	10	10	20	10
PHILIPPINES	15	—	20	20	—	—	20	10/15	10	—	—	15
PUERTO RICO	15	20/40	20/40	20/40	20/40	15	15	10	10	10	20	10
SOUTH AFRICA	20/40	40	20	20	—	—	—	—	10	10	15	15
U.S.S.R.	40	40/80	20	20	—	—	—	10/15	10/15	—	20	20
WEST COAST	20/40	20/40	20/40	40	40	—	—	10/15	10/15	10/15	10/15	20

CENTRAL UNITED STATES TO:

ALASKA	10/15	15	20	20	20	—	20	20	—	—	—	10/15
ARGENTINA	15	15	20/40	20/40	20	—	—	10	—	—	10	10/15
AUSTRALIA	10/15	15	15	—	20	20/40	40	20	—	—	15	10
CANAL ZONE	15/20	15/20	20/40	20/40	20/40	—	—	—	10/20	10/20	10	10
ENGLAND	40	40/80	40	—	—	—	—	—	15	15	20	20
HAWAII	15	15	15	20	20	20/40	40	20	—	10	10	10
INDIA	15	40/80	—	—	—	—	—	40/80	15	—	—	—
JAPAN	10/15	15	20	20	20	—	20	20	—	—	—	10/15
MEXICO	15/20	15/20	20/40	20/40	20/40	—	—	10/20	10/20	10	10	10
PHILIPPINES	40/15	—	20	20	—	—	—	—	40/15	40/15	—	—
PUERTO RICO	15/20	15/20	20/40	20/40	20/40	—	—	10/20	10/20	10	10	10
SOUTH AFRICA	—	—	20	20	—	—	—	—	15	15	15/20	20
U.S.S.R.	—	—	—	—	—	—	—	15	15	15	20	20

WESTERN UNITED STATES TO:

ALASKA	10/15	10/15	15	20	20	20	—	20	20	—	—	15
ARGENTINA	10/15	15	15	20	20	—	—	—	—	—	10	10
AUSTRALIA	10	10/15	15	15	20	20	20	—	20	—	—	—
CANAL ZONE	10	15	15/40	20/40	40	—	—	—	10	10	10	10
ENGLAND	20	20	—	—	—	—	—	—	15	15	15/20	20
HAWAII	10/15	10/15	15	15/20	20/40	20/40	40	—	15	10	—	—
INDIA	—	15	20	—	—	—	—	—	40/80	15	—	—
JAPAN	10/15	10/15	15	20	20	20	—	—	20	—	—	15
MEXICO	10	15	15/40	20/40	40	—	—	—	10	10	10	10
PHILIPPINES	10	10	—	—	—	—	—	20	15	15/20	—	—
PUERTO RICO	10	15	15/40	20/40	40	—	—	—	10	10	10	10
SOUTH AFRICA	20	20	—	20	—	—	—	—	—	10	15	15
U.S.S.R.	20	—	—	—	20	—	—	20	20	20	20	20
EAST COAST	20/40	20/40	20/40	40	40	—	—	10/15	10/15	10/15	10/15	20

* Try next higher band on "G" days. (1) Possible opening on this band on "G" days. (2) Try 60m.
Note A: Use values of 10/15 for 12m; 20 for 17m; 40 for 30m. Note B: This chart refers to the highest band possible at the time indicated. If no luck, try next lower band.

MAY 1992

SUN	MON	TUE	WED	THU	FRI	SAT
					1 F-G	2 G
3 G	4 G	5 G	6 G	7 G-F	8 F	9 F-G
10 G	11 G-F	12 F	13 F-G	14 G-F	15 F	16 F-G
17 G	18 G	19 G	20 G	21 G	22 G	23 G
24 G	25 G	26 G	27 G	28 G-F	29 F	30 F
31 F-P						

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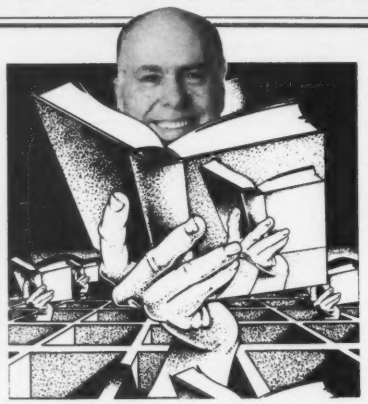

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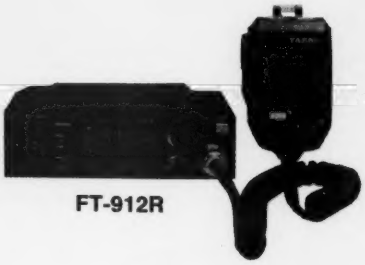

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